Design of Temperature Measurement and Control System of Chemical Instrument Based on Internet of Things

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Abstract. The traditional temperature measurement and control system of chemical instruments can not accurately grasp the basic condition of temperature data, resulting in low efficiency of measurement and control. Therefore, a temperature measurement and control system of chemical instruments based on the Internet of things is designed. According to the relevant performance of the hardware components of the system, the system information of the control center is studied, and the correlation of the internal system is studied. Based on this, the command of hardware mode transformation is executed. After the hardware design is realized, the system software design is realized on the premise of hardware data. Combined with the measurement and control algorithm, the measurement and control mode of the center is continuously studied, the data difference between the systems is adjusted, and the contradiction between the measurement and control data is avoided Complete the overall system design operation. The experimental results show that the design of chemical instrument temperature measurement and control system based on Internet of things has higher measurement and control efficiency, shorter measurement and control time, and improves the accuracy of measurement and control.

Keywords: Internet of things · Temperature measurement and control of chemical instruments · Temperature measurement and control system · Design of measurement and control system

1 Introduction

Chemical instruments will have a certain degree of danger during use. If improper operation will cause physical harm to users, for this reason, the use of chemical instruments must be investigated and supervised to improve their safety. Most researchers investigate the temperature status of chemical instrument, and use analysis algorithm to study the measurement and control information, so as to achieve the purpose of designing the temperature measurement and control system of chemical instrument.

Current research at home and abroad selects the required control data according to the authenticity of the system operation, and strengthens the internal data monitoring

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performance to ensure that the collected data is within the scope of the system operation to ensure the security of the control data [1].

Traditional chemical instrument temperature measurement and control system based on data mining technology uses Internet of things information skills to transform network data into system control data to achieve research and operation [2].

The traditional temperature measurement and control system for chemical instruments based on cloud computing achieves the purpose of measurement and control system design through the measurement and control calculation of the internal network system and the algorithm research. However, the current research does not select more accurate reference data, the degree of mastering the measurement and control system is low, which can not meet the needs of system operation [3]. Therefore, in view of the above problems, this paper designs a temperature measurement and control system of chemical instruments based on the Internet of things, and analyzes and solves the above problems. In this paper, a comprehensive data control method is designed, which improves the control accuracy of the control system, reduces the control time, and can better carry out the experimental research operation.

2 Hardware Design of Temperature Measurement and Control System of Chemical Instrument Based on Internet of Things

As a powerful data operation mode, the Internet of things has been widely used in data operation. In this paper, the status information of the Internet of Things is used to find the internal temperature data of chemical instruments, and the system hardware design operation is performed, and different operations are constructed according to different hardware properties. In order to strengthen the control accuracy of the control system, this paper sets up a data acquisition module, connects the channel between the data and the system, controls the collection strength of the data, and constructs the data collection diagram (Fig. 1):

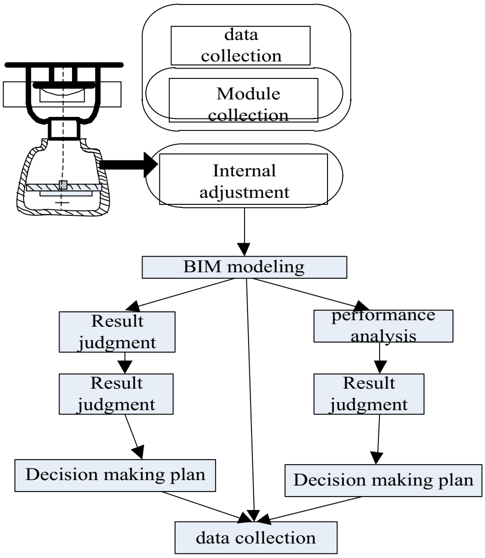

Fig. 1. Data collection diagram

The data collector in this paper adopts dczl23-wfet600s-i type collector, which adopts high-performance and low-power microcontroller hardware platform and embedded operating system software platform, with flexible system upgrading ability, supporting various communication modes such as power line carrier, micro power wireless, RS485 [4].

Uplink communication adopts a modular design, manages the operation information of the data system, and can transmit data information to the central control system while managing, and connects to the USB interface to ensure the security of data information transmission, and use different transmission channels to weaken the system data. Differential information promotes the unified development of data, eliminates the network signal data that does not conform to the operation of data system in time, and ensures the purity of data transmission.

According to the performance of data system control, further analysis of its necessary conditions, set up the corresponding data control module, standardize the processing of control data. In this paper, the data control module selects the control system mark controller, which has the function of serial port data acquisition, integrating resistance signal assistance, relay control and 485 communication. It can be applied to single coil SPI serial port encoder, displaying angle change and displacement change, serial port SSI three wire signal input, external power supply is 12 V or 5 V. It has absolute encoder with display serial port, meters of accumulated multi turn length, 0–10 k or 0 external access- 2.5 V. The voltage signal potentiometer, which is used in combination with the absolute value of single loop parallel port, can produce the use effect of multi loop absolute value, increase the success rate of data control, and study the main control chip status of the control system according to the process of central data analysis, so as to complete the design of data measurement and control module [5].

In this paper, the control chip is an IC that integrates a controller and a driver. It can independently control two robot gait data systems at the same time. It is a powerful system-on-a-chip. It integrates complex in a miniature 7 mm × 7 mm QFN package. The Six Point ramp generator, as well as industry-leading diagnostic and protection features.

With the addition of steadthchop silent driving technology, spread cycle anti jitter technology, coolstep current dynamic adjustment technology, it can save 75% energy. With dcstep torque adjustment technology and stallgard locked rotor detection function, it can promote the optimization of the system. With the expansion of n-channel MOSFETs, the motor current of each coil can reach 20A, and the voltage is 60 V DC, easy to operate, only need to find the target parameters, all the instrument temperature data system logic are running in the tmc5160. When NEMA 17 to NEMA 34 and larger systems are driven, no software operation is required, saving operation time, and improving control efficiency [6]. Connected to the host microcontroller via industry standard SPI or step/direction interface, TMC5160 performs all real-time position and speed step motion calculations. At the same time, TMC5160 also supports ABN encoder input to optimize input port data information and facilitate internal structure Sexual operation can provide relevant information on the basis of joint conversion, and strengthen the information analysis of internal control data.

According to the above steps, adjust the hardware structure of the system, and realize the research and operation of the hardware of the multi-point control system of the network engineering virtual unit [7].

The MSU processor in the node has the function of timed sleep, which can reduce the cost of power consumption. It is mainly responsible for the screening and transmission of analog quantities. The A/D conversion function in the processor can reduce the complexity of analog quantity screening, considering the power supply voltage. Differently add a capacitor in the MSU processor to reduce the impact of the voltage difference.

Each node has a set of analog interface circuit, which can timely transmit the real-time environment information collected from the orchard to the next data layer through the interface. In this system, the node analog interface circuit adopts the analog front-end with current signal of 2ma–10ma, and converts the current into voltage signal through the front-end.

The high-definition vision node is mainly composed of the grid high-definition electronic eye as the main body of the visual node. It is reliably powered by the JW48V–6A power adapter. A color processing chip is installed in the gate high-definition electronic eye, which improves the sensitivity and resolution of the electronic lens, and enhances the color processing ability, automatic light filling ability and automatic focusing ability of the electronic eye [8]. This can realize the high-definition vision node, which can provide 24-h security protection for the entire orchard range. The high-definition vision node is also equipped with a data computing platform, which can accurately measure the terrain position. The computing platform uses the D-2015 J model motor as the The drive provides a stable and sensitive environment for data operation.

3 Software Design of Temperature Measurement and Control System for Chemical Instruments Based on Internet of Things

After realizing the hardware design of the system, based on the operation data of the hardware system, this paper changes the data operation conditions, and stores the collected data in the network structure space in combination with the big data calculation mode. The operation flow chart of the relevant system software is set as follows (Fig. 2):

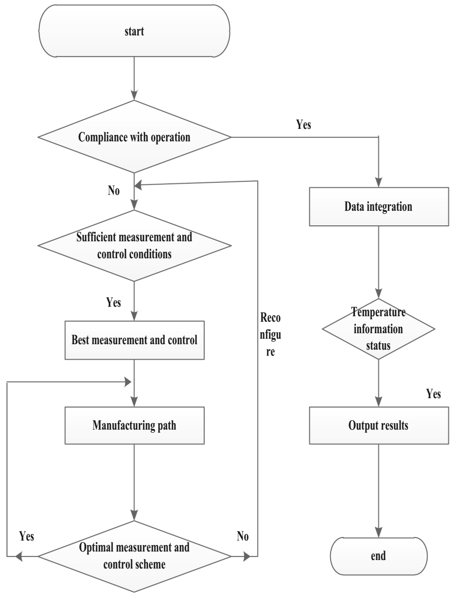

Fig. 2. Software operation flow chart

At the beginning of the program, the transmission node communicates commands to other nodes in the form of numbers. After receiving the command, the other nodes enter the Internet of Things. After the other nodes are successfully connected, they start to send real-time environmental information of the orchard to the transmission node. The node applies for joining the network and transmits information. After receiving the request, the transmitting node needs to check whether the node has the conditions to join the network in the network address. If it does not meet the conditions, it refuses to join; if it meets the conditions, it can join.

According to the structure sequence, the multi-point data of network engineering virtual unit is allocated and the data training operation is carried out. The big data calculation and analysis data and the multi-point data of the virtual unit are transmitted to the same operation channel, and the corresponding data transmission formula is set:

$$C = \sqrt{A + P} - \frac{S + U}{N} \tag{1}$$

In the above formula, C represents data transmission parameters, A represents operating channel environment data, P represents network structure space data, S represents virtual unit multi-point data storage location parameters, U represents data training sample parameters, and N represents the total number of data involved in data transmission. After the above research and operation, the transmitted data will be placed in the control system. After the system control of data is realized, the data location of the control will be allocated, and the data control area will be divided by referring to the multi-point data control content of the network engineering virtual unit, and the control parameters will always be within the adjustable range of the system. Further set the data parameter range control equation as follows:

$$C = \sum P + \frac{q - m}{T} \tag{2}$$

In the above formula, C represents the data control range data, P represents the basic parameters of the control area, q represents the allocation data location parameters, m represents the control content parameters, and T represents the system control space data information. Therefore, obtain the required range data, set the data operation range, standardize the management of internal system information, and transfer all the information in the system operation range to the control space, monitor the data position at all times, and there is a certain operation relationship between the data. The software in this paper alleviates certain data contradictions by cracking its relationship [9].First look for relational data, determine the possibility of operation between the data through the corresponding content of the relational data, and set the data determination formula to adjust the difference between the data:

$$P = \frac{k - l}{z} \cdot (u + d) \tag{3}$$

In the above formula, P is the data determination parameter, K is the data contradiction possibility parameter, l is the relational data information, Z is the software system operation function, u is the operation relationship index between data, and D is the internal space operation index [10–12].

According to the above operation, enhance the adjustment performance of internal data information, and combine the research content of the control system to convert the control data into control research data, maintain the operating distance between the data, improve the function of the information control system, complete the temperature measurement and control system of the chemical instrument Design research [13–15].

4 Experiment and Research

In view of the complexity of the operation data of the Internet of things and the difficulty in measuring the instrument temperature data of the chemical instrument temperature measurement and control system, it is necessary to screen the data of the experimental environment, adjust the original system state, continuously optimize the internal structure of the system, change the performance of information collection and analysis, implement the data measurement and control operation according to the relevant measurement and control principles, and strengthen the connection between information,

After each module of the node establishes the route, the MSU processing module will enter the low loss mode by using the timing sleep gap of the node. At this time, the whole system will enter the low loss stage. The trigger timer can use the timing sensor to collect and transmit the data. The basic function of the trigger timer is as follows:

$$S = \sum_{\mathrm{i}=0} L + \frac{L_2}{C} \tag{4}$$

In the function, S represents the trigger time, L represents the starting module working time, represents the module enters low-loss time, and C represents the module's operating efficiency.

When the system node under low loss receives the command information outside the system, the normal operation of the entire system is resumed by changing the time address of the timer for the first time. The peripheral circuit of the MSU processor is shown in Fig. 3:

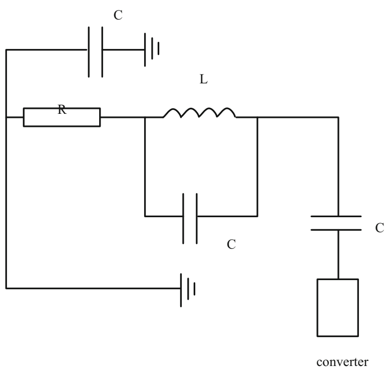

Fig. 3. Peripheral circuit of MSU processor

In this experiment, according to two different experimental parameters for experimental comparison, to further improve the overall comparison effect, and set the corresponding experimental parameter table as shown below (Table 1):

Table 1. Experimental parameters 1

Project	Parameter
Voltage	10 V
Network signal status	Stable
Program status	Offline
Run the model	IoT operation model
Analysis method	Platform computing analysis

In order to verify the effectiveness of the system in this paper, under the condition of experimental parameter 1, the efficiency of the temperature measurement and control of the chemical instrument temperature measurement and control system in this paper, the chemical instrument temperature measurement and control system based on data mining technology and the chemical instrument temperature measurement and control system based on data mining technology Analysis, the comparison results are shown in Fig. 4.

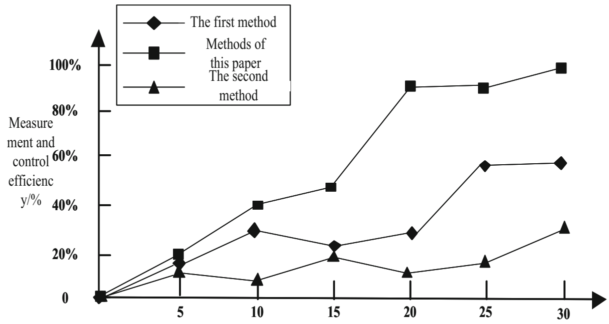

Fig. 4. Comparison of measurement and control efficiency

According to the above diagram, it can be analyzed that the traditional measurement and control system based on the data mining technology of chemical instrument temperature measurement and control is more efficient. Because this method centrally controls the operation performance of acquiring data, and studies the transformation direction of the internal system structure, the measurement and control according to the data. The standardized standard of data manipulation to improve the efficiency of measurement and control.

The traditional temperature measurement and control system of chemical instruments based on cloud computing has a low efficiency. Because the method has a small monitoring force on the internal data of the system, it reduces the effectiveness of data conversion, and the control concentration is weak, resulting in a low efficiency of measurement and control.

The measurement and control efficiency of the temperature measurement and control system of the chemical instrument based on the Internet of Things in this article is higher than that of the other two traditional methods. Contradiction with system control, to avoid data measurement and control errors during operation, and improve the efficiency of measurement and control.

Set the experimental parameter 2 for the secondary data performance test (Table 2):

Table 2. Experimental parameters 2

Project	Parameter
Monitoring program status	Connection Status
Network structure	Complete
Risk factor	0
Frame status	Basic framework
Interface	USB interface

In order to further verify the effectiveness of the system in this paper, under the condition of experimental parameter 2, the temperature measurement and control time of the chemical instrument temperature measurement and control system in this paper, the chemical instrument temperature measurement and control system based on data mining technology and the chemical instrument temperature measurement and control system based on data mining technology are compared Analysis, the comparison results are shown in Fig. 5.

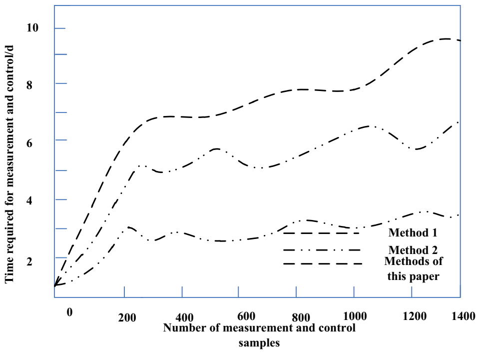

Fig. 5. Experimental comparison

According to the above diagram, it can be analyzed that the traditional design of chemical instrument temperature measurement and control system based on data mining technology takes a long time, while the traditional design of chemical instrument temperature measurement and control system based on cloud computing takes a short time. In this paper, the measurement and control time of chemical instrument temperature measurement and control system based on Internet of things is shorter than the other two traditional system designs. The reason for this difference lies in the system design and research of the internal information situation of the system, and find out the reasons for the state of the system, increase the data collection efforts, and store the data according to the relevant spatial data comparison system storage mode.

To a large extent, it ensures the accuracy of data storage, reduces unnecessary troubles, facilitates control operation, improves the efficiency of measurement and control, and reduces the time required for measurement and control operation. The traditional chemical instrument temperature measurement and control system based on data mining technology has designed and studied the integration mechanism between the data. Based on the management system center data, the temperature data is reviewed and analyzed to better control the performance of the system's control center and has a relatively stable Measurement and control route, but the operation steps are more complicated, with more repetitive steps, resulting in a certain amount of operation waste, resulting in a longer time for measurement and control.

The traditional design of temperature measurement and control system for chemical instruments based on cloud computing can control the flow direction and flow state of gait data while ensuring the effective transmission of information, which shortens the time required for measurement and control. However, because of this, the mastery of data is low, which can not meet the operation requirements of the system, and there are still deficiencies in control functions, unstable control routes, and efficient measurement and control Lower.

In summary, the design of the temperature measurement and control system for chemical instruments based on the Internet of Things in this paper can better adjust the contradictions between the systems, solve the system data information in time, control the effective circulation of temperature data, simplify the operation process, and avoid unnecessary waste of time. Has a broader space for development.

In order to further verify the effectiveness of the system in this paper, the temperature measurement and control accuracy of the traditional measurement and control system and the measurement and control system in this paper are compared and analyzed. The comparison results are shown in Fig. 6.

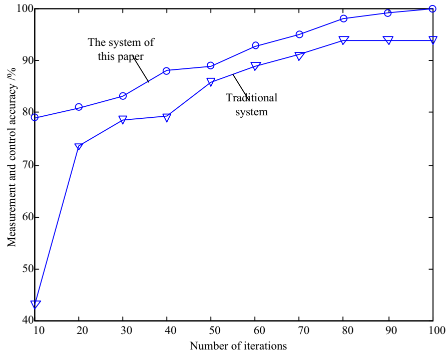

Fig. 6. Comparison of measurement and control precision results

According to Fig. 6, the temperature measurement and control accuracy of chemical instrument in this system can reach 100%, while that of traditional system is only 93%. The accuracy of temperature measurement and control of chemical instrument in this system is higher than that of traditional system.

5 Conclusion

Based on the traditional instrument temperature measurement and control system, this paper designs a new type of chemical instrument temperature measurement and control system based on the Internet of Things. The experimental results show that the design effect of the system is significantly better than that of the traditional system. This paper focuses on the operation characteristics of hardware and software design, reduces the contradiction rate in the design, and constantly adjusts the system space structure, optimizes the internal space state, simplifies the operation process, reduces unnecessary operation waste, can improve the information of the central components of the control system to a higher extent, has a higher operational feasibility, reasonably distributes the system operation principles, and strengthens the The data control performance of the control system can improve its control accuracy, which provides a solid theoretical basis for the follow-up research. The design effect is good and has a high research value.

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