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Application research of Welding process monitoring system based on LAN

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Abstract. In the field of production and manufacturing, the monitoring of welding information and analysis of post-welding signal is an important technical means to ensure the overall quality of work. Monitoring the information parameters in the welding process and comprehensively mastering the construction process of welding process can not only quickly obtain the working status of the staff, but also take the collected signal as the basis for quality evaluation. Based on the research status of welding process monitoring system in the new era, this paper discusses the design of monitoring system for real-time acquisition of welding process information, and makes clear the application principle of signal analysis, management module and quality evaluation system. The final results show that the overall system design can not only manage the real-time data, but also optimize the welding technology and improve the quality of welding work.

Keywords: LAN; Welding processing; Monitoring system; Signal analysis; Data signal

1. Introduction

In the innovation and development of modern science and technology, sensor technology, computer technology, automatic control technology, etc., have been widely used in the manufacturing industry, bringing opportunities and challenges for the development of modern production and manufacturing. Advanced manufacturing systems such as systematization, integration and information technology have put forward higher requirements for the development of welding production and manufacturing technology. Among them, digital production technology is a hot topic in scientific research. The data information during welding is the basic condition of digital welding production, and it is an important technology to realize remote monitoring of process parameters, on-line prediction of welding quality and on-line management of welding production process. Information data during welding, including current, voltage, temperature, welding gun position and other contents, will generate a large number of signals with the implementation of welding, comprehensive collection and integration analysis, is of great significance for monitoring the welding process and management of welding production. Digital welding production technology, as the core content of the discussion on the innovation and development of modern science and technology, fully integrates advanced welding production technology and digital technology together. The specific content involves the following points: first, the information data during the monitoring and control of welding; Second, digital welding power supply; Third, precision CNC automatic welding device; Fourth, the digital welding during the network management system; Fifth, the use of finite element, expert system, database and other technologies to achieve data management, process design, structure design, simulation and so on. From the perspective of practical application, digital welding production is a multi-field integration technology, which needs to store rich practical experience and theoretical knowledge, strengthen the basic and comprehensive research efforts, and pay attention to the specific problems to put forward effective application programs.[1-3]

In the current market construction and development, there are many welding processing technologies applied in the field of production and manufacturing, among which the most representative is arc welding, which accounts for more than 60% of the total production labor nationwide. Therefore, the process quality and production efficiency of arc welding products have been widely concerned by people. Nowadays, in order to further optimize the quality of welded seam, scholars from various countries will analyze the components according to relevant technical

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standards before manufacturing, and then do a good job of welding process evaluation, and finally put forward standardized and perfect welding process procedures. But from the point of view of practical work, most welders have the work consciousness is not standardized, the application of technical procedures are not perfect and other problems, even if the welding workers in strict accordance with the process of operation, will be affected by internal and external factors can not guarantee the quality of welding. Therefore, researchers put forward effective detection technology during welding process, its purpose is to ensure the quality of welding production. In the traditional sense, there are two kinds of inspection methods, one is nondestructive testing, the other is destructive testing. Due to the limitations of both in application and the low efficiency of practical operation, the defects of welding technology cannot be directly demonstrated. Therefore, this paper takes current and voltage signals in welding process as the core to build a real-time monitoring and quality analysis system, so as to help staff quickly obtain the changing characteristics of various parameters and truly meet the requirements of standardized welding process. In this way, welding production quality and efficiency can be improved.[4-6]

Nowadays, scholars at home and abroad have conducted a number of studies based on automatic detection technology. People gradually realize that information monitoring of welding process is a comprehensive technology, including signal analysis, control technology, sensor technology, computer technology, etc., which plays an important role in the development of information monitoring technology in welding process. In the early stage of technology research and development, due to the limitations of technical theories and other factors, scholars usually use low-grade microcomputer system or single-chip microcomputer to complete the parameter collection, sorting and analysis. At this time, whether domestic or foreign research institutions, they can monitor in real time and record the current and voltage signals during welding. After the end of sampling, conclusions can be drawn according to statistical results. In the 21st century, with the continuous development of computer technology and sensor technology, the research of welding process information data monitoring has made substantial progress, which can not only break through the restrictions of electrical signal monitoring, but also introduce a large number of new welding technology. Therefore, this paper mainly studies the application content of welding process monitoring system with local area network as the core, realizes software programming with Lab VIEW language, gives full play to the technical advantages of virtual equipment and instruments, and collects a large number of current and voltage data signals, so as to lay the foundation for the construction and development of digital welding production technology on the basis of data sharing.[7-9]

2. Method

2.1 System Design

Combined with the system structure analysis shown in the following figure, it can be seen that the overall design consists of two parts, one is the hardware acquisition system, the other is the software design system:

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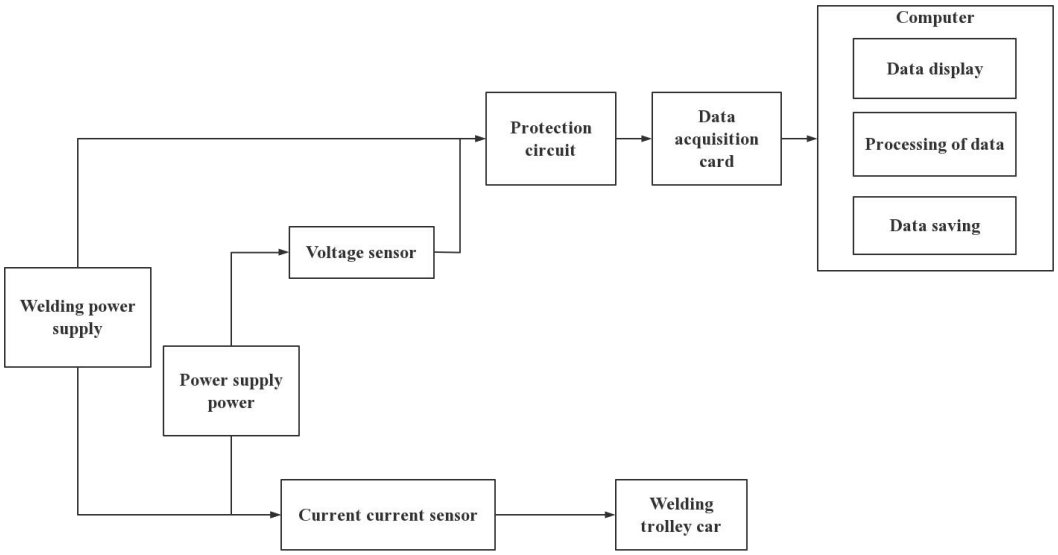

Figure 1 System structure diagram

Based on the analysis in the figure above, it is found that the hardware acquisition system will use sensors and data acquisition cards to collect data signals of current and voltage during welding at the welding work site in real time, and then directly input them into the on-site computer, which is regarded as the data source. After connecting to the LAN, all computers in the network can directly access and read the stored data. Then the whole welding process is monitored and analyzed in real time. As the hardware design is the basic part of the whole system operation, it is mainly responsible for collecting welding current and voltage data signals from the welding site. Therefore, the practical working environment is harsh, and it is necessary to have strong resistance to interference. Only in this way can the accuracy of data collection be guaranteed. Generally speaking, the hardware acquisition system consists of three parts, the first is the sensor, the second is the acquisition card, and the last is the computer. The specific structure is shown in Figure 2 below:[10-12]

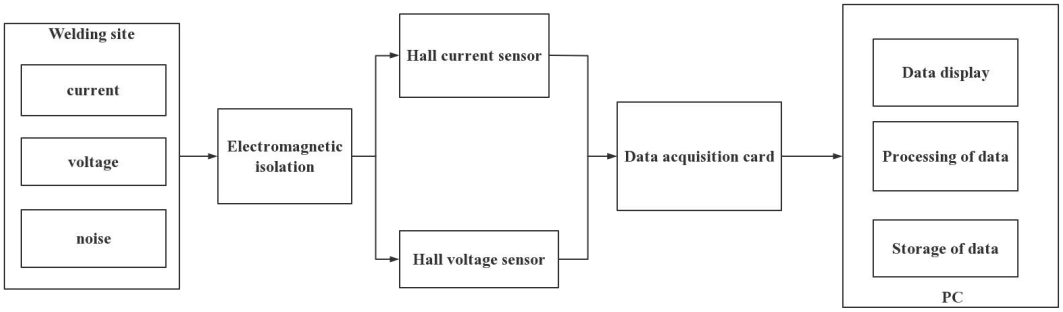

Figure 2 Structure diagram of hardware acquisition system

The software system is the basic condition of the work of the virtual equipment and instrument, which can realize the functions of the virtual instrument. In this research system, based on the real-time requirements of software design, the Lab VIEW virtual instrument development platform is used to write the overall architecture and main functions of the software system, and the database software is used to build different types of subsystems, and then the basic data storage and transmission are completed. At the same time, the overall system software design should abide by the following principles: First, modularity. The program with general functions is designed as V1. In programming operation, the use of sub-V1 can not only improve the efficiency of system development, but also optimize the readability of the program and reduce the amount of memory occupied by the program, so as to facilitate the expansion of the program and maintenance and repair; Second, optimize the speed. The core function of the whole system is to collect and present

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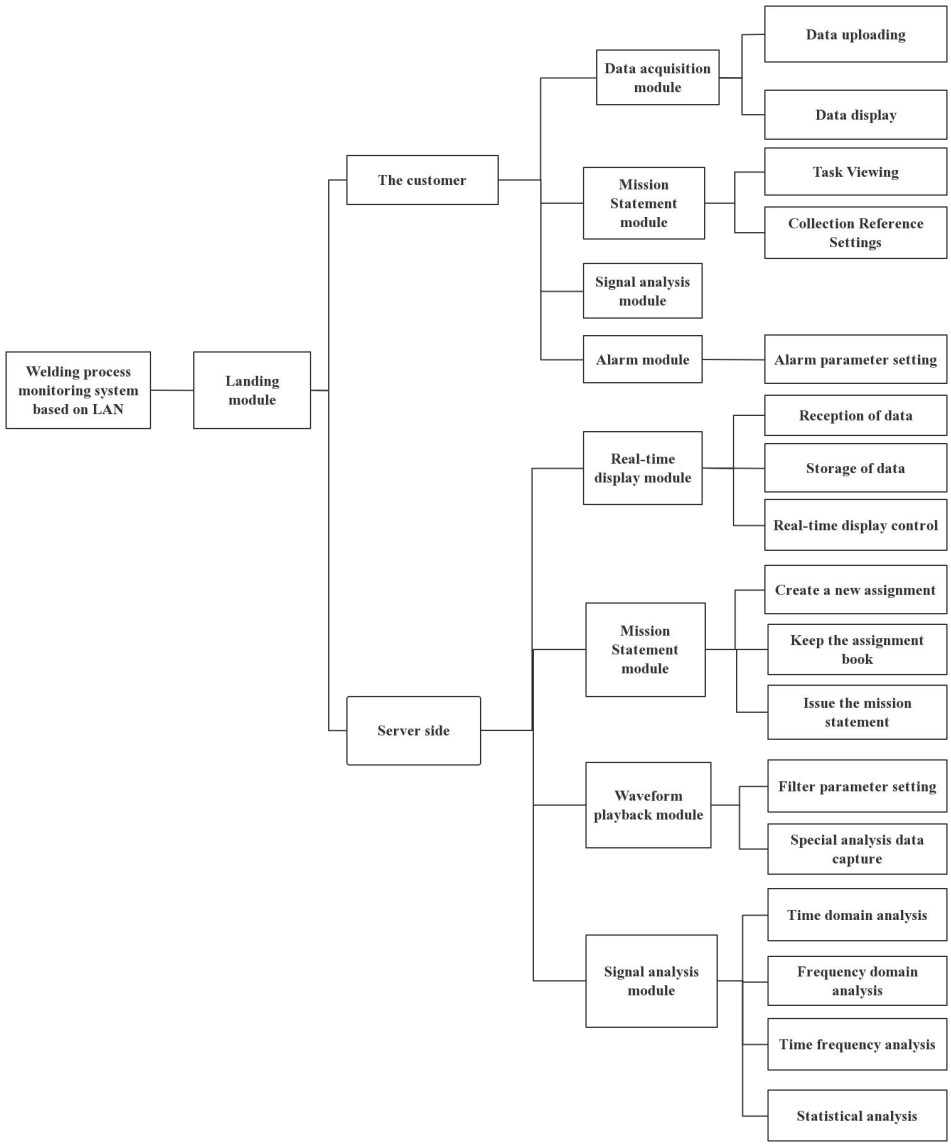
data signals, so the real-time performance and execution speed of the system are very high. Finally, the human-computer interface. Good system structure can not only provide technical support for functional operation, but also better to meet the basic needs of system users. The human-machine interaction interface is designed according to the operating habits of welding producers. Both functional design and mirror design can further improve the performance of the system, reduce the professional requirements of operators, and reduce the training time of software applications. In this paper, the software structure of the monitoring system is designed in a modular way, which can better improve the scalability of the system and provide convenient conditions for the subsequent functional development and research. The specific structure is shown in Figure 3 below:



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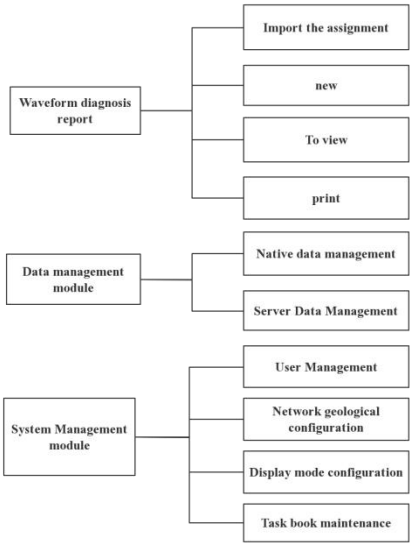

Figure 3. Structure diagram of software functions

2.2 Information Collection module

In the welding process, the collection of information is the basic function of the monitoring system, but also an effective channel for the system operation to obtain data. The real-time and accuracy of information transmission directly affects the realization of the overall function. Therefore, the design and development of information acquisition module program can help staff accurately analyze the close relationship between welding process parameter changes and welding quality, and lay the foundation for the orderly operation of the monitoring system.[13-15]

2.3 Information Analysis module

Because the knowledge of information acquisition module provides simple welding current and welding voltage waveform diagram, although the basic information in the welding process can be mastered without the help of signal analysis method, in order to have a deeper understanding of the welding production process and clarify the relationship between current and voltage and welding quality, it is necessary to introduce a signal analysis method that meets the requirements. Quickly grasp the connection between waveform change and welding parameter change, and then complete the preliminary analysis and prediction according to the joint quality.

2.4 Management system program

The welding process monitoring system with local area network as the core must have a perfect management system, which is used for management and maintenance, collection and control of user rights, distribution of system network address, guarantee system security and so on. This paper studies the system management module, which is mainly to maintain and control the daily functions to ensure the normal operation of the overall monitoring system. The user management module is the basic part, which is operated according to the user registration module in Figure 4 and the user login module in Figure 5 below. The user registration needs to be judged three times. First, the user name is judged to be repeated, then the user password is judged to be correct, and finally the management personnel judge and analyze the user authority, so as to complete the user registration.

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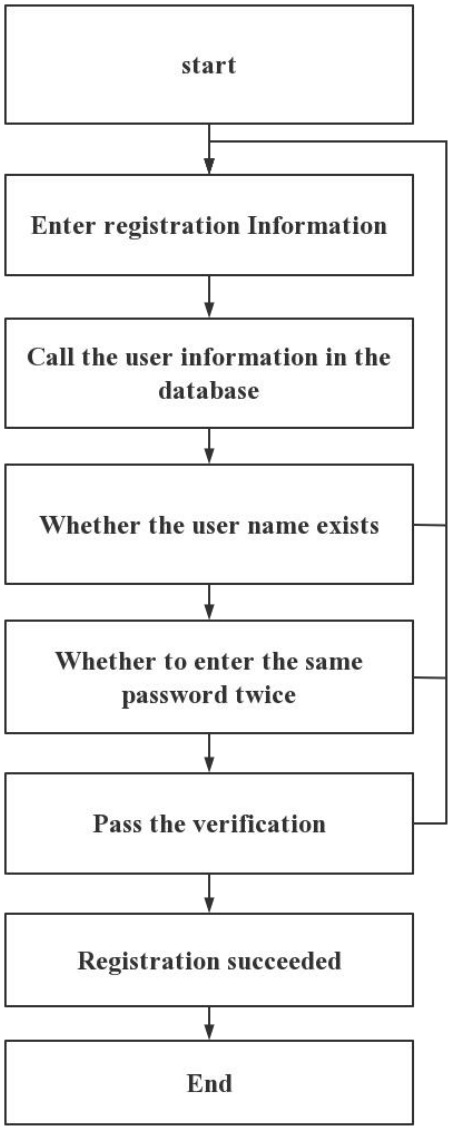

Figure 4. Flow chart of user registration module

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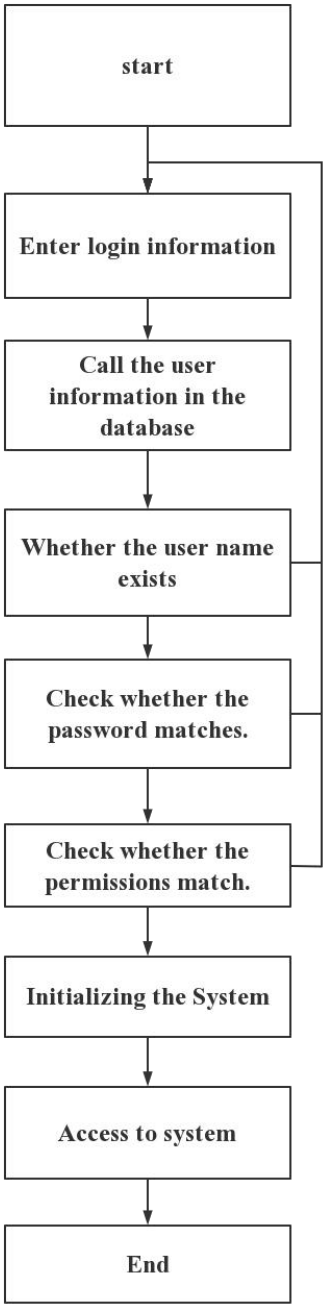

Figure 5 Flow chart of user login module

3. Result analysis

Based on the analysis of the local area network structure as shown in Figure 6 below, it can be seen that the welding process monitoring system should be constructed with the welding production quality management as the main objective, and focus on the design of real-time information monitoring and signal analysis modules. The former is used to obtain data signals and evaluate the working quality of the welding production process. The latter evaluates the working quality of the overall welding production in the analytical study.

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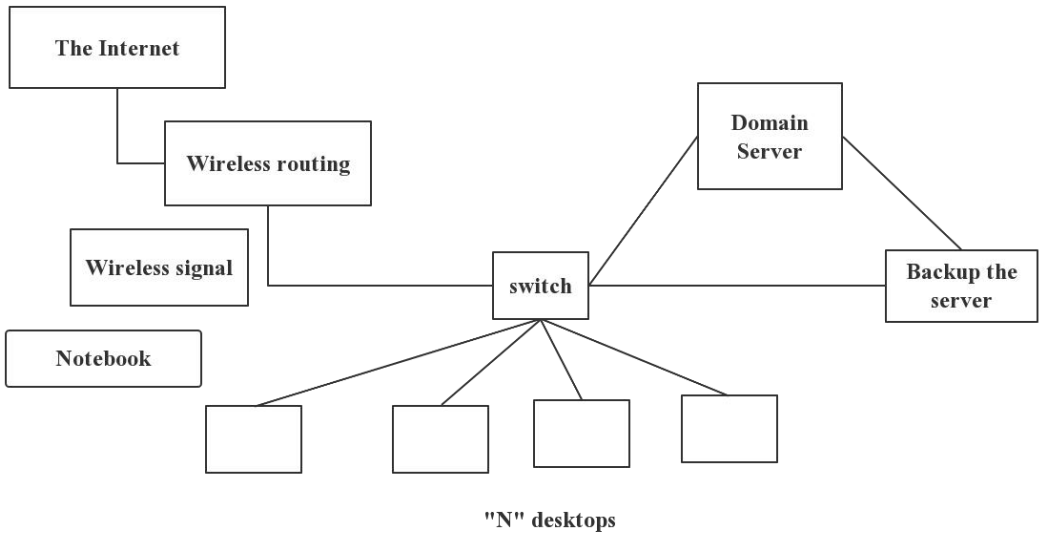

Figure 6 Structure diagram of LAN

From the perspective of the long-term development of our modern production and manufacturing field, the future system research should integrate artificial neuron network technology for optimization and innovation, and change the traditional system analysis process with rich experience as the core. Firstly, the signal analysis results are quantified, and these parameters are regarded as input values to clarify the stability index in the welding production process. The probability of various welding defects is regarded as output parameters. After the artificial neural network model is built, the intelligent welding production quality evaluation analysis is completed. At the same time, the monitoring system and welding process design expert system should be organically integrated together, so as to build a more complete production quality management system, convenient management personnel, all-round monitoring of process formulation, process implementation, implementation effect, fully mobilize the enthusiasm of employees in all departments, improve the work efficiency and quality of welding production.

Conclusion

To sum up, the welding process monitoring system based on LAN studied in this paper can not only solve the problems existing in traditional welding production, but also improve the working efficiency and product quality of welding production. Therefore, Chinese research scholars should continue to discuss the internal design of welding process monitoring system on the basis of the integration of practical research results, strengthen the training of professional and technical talents, actively introduce advanced technology theory, guide our production and manufacturing industry, and move forward steadily towards the direction of intelligence and digitalization.

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