Research on Intelligent Manufacturing of Coal Machine Equipment Based on Computer Informatization Coal Machine Equipment

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Abstract. Coal preparation can remove most of the impurities in raw coal, reduce ash, and improve coal quality. Reducing the ineffective transportation of vermiculite, reducing the environmental pollution caused by burning coal, and providing the basic guarantee for the further clean and efficient use of coal are the foundation of clean coal technology. The domestic status of the automation technology of the coal preparation plant is introduced, and the issues needing attention in the automation technology of the coal preparation plant in China are introduced. Briefly describe the main contents of the current coal preparation plant automation technology and the issues needing attention in the control loop, and the possible consequences of an unreasonable design of the coal preparation plant automation system. By analyzing the development trend of the automation technology of the coal preparation plant, the broader development prospects of optimal control and video surveillance substation technology are expected. The scientific development of the coal preparation plant is to make full use of advanced coal preparation technologies, processes and equipment, improve the raw coal selection rate, continuously improve and improve the process, develop and introduce new efficient and high-yield washing equipment, and improve automation, professionalism, and informationization. And intelligence

1. Introduction

With the continuous development of the market economy, people's demand for energy has also increased dramatically, and ensuring the long-term stability of coal resource supply has become the key to maintaining social stability and sustainable development of people's quality of life. Applying automation control technology at the coal preparation plant and rationalizing the design to improve the level of automation and control at the coal preparation plant will help reduce no-load losses, reduce production costs and labor intensity, improve coal preparation efficiency and dispatch command efficiency, thereby achieving better comprehensive economic benefits. The research and analysis of the application and practice of the automation control technology in the coal preparation plant and its computer application can help to improve the level of automation control technology in the coal preparation plant.
2. Definition and practical significance of automation control technology in coal preparation plant

2.1. Definition of automation control
The automation control system can meet today's high-efficiency work, and has moved to data field management. The key issue is the scope of control, which realizes some compatible amounts brought by control, so a more secure control platform needs to be designed. The first is the equipment of the system. A complete set of input devices is the basic hardware of the entire system. It is a device located at the bottom of the entire system, including sensors and other field devices, and also includes operating equipment such as operating platforms and servers. Second, it is a network laying. There are two types of networks: management network and control network. The control network trial at the production site is the main connection between the field and the equipment and the laying of the bus structure, while the management network is located between the equipment and the operation. It is generally in the Ethernet mode. The use of the Ethernet also has universal applicability. It is a communication field with a large scope of application. It is characterized by low applicable cost of input and more types of media to choose from. Because of its many advantages such as fast operation and convenient network laying, it can be widely accepted during use [1].

2.2. Automatic control technology can be widely used in coal preparation plants, it is two-way inevitable trend of choice
Because first, the current social development is inseparable from coal resources. As the market demand for coal resources continues to increase, there are stricter requirements on its quality, production efficiency, and comprehensive benefits. It is in the technological era of automatic control technology. The choice is realistic. Second, because science and technology are the primary productive forces, the meaning and purpose of automated control technology is to serve actual production activities. Therefore, it is an inevitable method to apply this technology to coal preparation plants. The most important reason has been proved by experiments that the use of automatic control technology in coal preparation production activities not only reduces production costs and no-load losses, but also improves the command and dispatch operation rate, and also improves product quality and environmental benefits [2].

3. Status of Automation Control Technology in Coal Preparation Plants in China
In the coal preparation process, it is not possible to rely solely on manual operations to carry out the work. Automated control technology should also be used. In the automatic control technology, it is necessary to continuously adjust and detect the devices of the automatic instruments, so that the coal preparation automation can be carried out smoothly and effectively. With the fierce competition in China's coal preparation market, the coal preparation industry has also developed rapidly, and the requirements for automation technology have continued to increase during the coal preparation process. From the previous time, only online monitoring and accident monitoring of centralized equipment and process parameters were performed. The alarm, until now, can fully implement automatic control of production equipment and parameters in the entire production process of the coal preparation plant, so that the original single automatic equipment control to the overall control of the coal preparation plant. In addition, the management and control of the computer technology of the coal preparation plant have been strengthened, and the automation control level of the coal preparation plant has been significantly improved [3].
4. The Key Technology Analysis of Automation Control in Coal Preparation Plant

This paper takes a coal plant as an example to analyze the automation control technology. The daily production of raw coal in this coal plant can reach a very high level, and the annual washing capacity of its affiliated coal preparation plant can also reach the top ten thousand tons in the province. Therefore, in the context of the development of the new era, in order to meet the increasing demand, the coal plant began to use modern technology concepts, of which automation control technology is the best. Now the washing capacity has been increased to a higher level every year, which effectively improves the quality and efficiency of coal preparation guarantee the safety of practical work. The following is a deep exploration of the key technologies in its practical application.

4.1. Selection of control system and electrical facilities

By understanding the actual conditions and production conditions of the coal plant, it is proposed that the core of the overall automation control system will be centralized control and positioning, and a complete distributed control system will be formed with the corresponding data layer and equipment layer. Staff can help in this system in this way, the operation status of the facility is clarified in a timely manner, production-related data is automatically collected, and alarms are raised in time if problems are found, so as to ensure the safety of the overall system operation. In addition, the staff must install a central control room and management machine based on the actual work requirements of the factory. The specific number is analyzed in combination with the actual situation, and data is collected and managed in accordance with the bus control to comprehensively manage the field station. It should be noted that even the most advanced technology needs to be operated with the support of supporting facilities. Therefore, regarding the problems existing in the traditional switch of the chute jam monitoring at the coal preparation plant, the staff must use the automation control technology as the basis and clearly select the radio-optical Switch and RF capacitor level switch to improve the efficiency of practical detection, and practice has proved that this choice is correct [4].

4.2. Collection of facility operation data and status information

Because the previously cited ecosystem of this coal plant is difficult to find hidden problems in time, this will not only increase the difficulty of production work, but also extend the production time and reduce the actual production quality. In order to solve this problem, the staff must use automatic control technology as the basis, provide the required switching value for the site, and form a corresponding secondary circuit on the basis of the PLC, and then comprehensively manage the field equipment based on timely collection of operating data required by the facility. Among them, the data transmission between facilities and network nodes should take the bus as the core, so that the actual operation data
can be fully displayed on the PLC, which can provide an effective basis for the staff's practical operation [5].

4.3. Remote control process for real-time communication
In the traditional sense, the coal preparation plant generally focuses on automobile transportation and is equipped with professional workers to manage the loading valve to complete the car loading work. However, because the actual environment of the coal preparation plant is more complicated, the loading point Not only is the quantity large and too scattered, so the amount of labor required is also increasing. At this time, it is easy to increase the cost and affect the actual work efficiency. In this context, workers must combine automation control technology to provide suitable monitoring equipment and communication facilities at the production site, so that they can remotely manage and operate product loading with the help of a centralized control system. In this work, the staff must ensure that the communication facilities have sufficient volume, and in many practices, choose an installation location that does not restrict the operation of the car. Taking the camera as an example, the staff must observe the process of the discharge valve in practice. And then install it under the loading compartment. In addition, in the working state, the staff must have a serious, responsible, motivated and persistent work attitude, observe the work images in time, and then issue effective orders to the field staff according to the dispatch phone, which will help improve practical work Efficiency, reducing unnecessary time consumption.

4.4. Construction of a suitable comprehensive management information system
It has been passed that the coal plant computer data information plays an important role in the operation of the coal preparation plant, so it is important to build a reasonable comprehensive information management system. Taking this coal plant as an example, after deep exploration, the staff found that, to ensure the orderly implementation of practical work, it is necessary to take production management, quality management and scheduling management as the core, integrate a comprehensive information management system to build a complete and integrated Information management system, and provide an integrated work platform for review and processing for staff [6].

![Figure 2. FrameConstruction of Coal Mine Factory Automation Information Network](image)

5. Problems
With the increasingly fierce market competition, the traditional manual operation methods of the manufacturing industry are facing many challenges and cannot meet the market requirements. The manufacturing industry is urgently facing the problem of transformation and upgrading. At present, the traditional coal machine enterprises have the following problems:
(1) The enterprise has successfully used ERP, OA and other office management software in the construction of informatization, and the degree of informatization is low. In production, most of the equipment has realized the collection of operating data (manual and automatic combination). However, the current problem is how to automatically collect and store the data generated by the equipment operation through informatization, instead of the current management form of manual copying by paper forms, thereby improving work efficiency. At the same time, the data of production management software can be connected to office software such as ERP to realize the sharing of enterprise data.

(2) The production workshop has the problems of large material flow, many production links, and many special operations that need to be performed in the production link. There are many varieties and small batches of production orders.

(3) The existing intelligent design schemes are mainly automated production designs, and are not combined with informatization.

6. Basic ideas for planning and development

6.1. Master planning goals
Through rational planning, scientific organization, and phased implementation, improve the process and management processes, add intelligent manufacturing units, achieve efficient management, flexible production, lean production, improve manufacturing efficiency and product quality, reduce product costs and resource consumption, and transform the plant into Intelligent industrial plant area with reasonable layout, modern facilities, management informationization, and industrial clustering.

6.2. General planning layout

![Figure 3. Computerized information coal machine equipment coal machine equipment](image)

In view of the specific situation of the company's machining, assembly and transportation, combined with the existing core technology of intelligent manufacturing, to create a process, production as the main line, information technology as the means, and the industrial Internet of Things as the carrier, from the upstream supply chain management to itself The digital workshop factory and downstream customers' operation and maintenance management and control are integrated into a T-shaped eco-smart intelligent factory, supplemented by lean management, which greatly improves the factory's own
intelligence level and anti-risk capabilities [5]. According to the organizational structure and actual production mode of coal mining equipment enterprises, coal mining intelligent factories can be divided into equipment layer, control layer, management layer, and enterprise layer [6]. The overall architecture diagram is shown in Figure 1.

The control layer mainly includes PLC, data acquisition system and monitoring system (SCADA), etc., to implement centralized control and data acquisition functions of the underlying equipment; the management layer implements production management at each workshop level, product lifecycle management, and information network security management. The enterprise layer is based on industrial Ethernet and the Internet of Things to achieve the overall production management of the enterprise, including information management systems such as enterprise resource planning (ERP), product lifecycle management (PLM), and warehouse management system (WMS).

6.3. Construction Content
The project planning scheme adopts a one-time planning and three-phase implementation method, and combines the actual situation of the enterprise to divide the specific content of the plan into three major modules: intelligent product upgrade, intelligent production transformation, and factory information transformation. The specific transformation content of its three major modules is shown in Table 1.

| Serial number | Transformation direction | Transformation content                                                                 |
|---------------|--------------------------|----------------------------------------------------------------------------------------|
| 1             | Intelligent transformation and upgrading of products | Product intelligent transformation and upgrade, special control system and precision electrical integrated production department, process research and development center. |
| 2             | Factory production intelligent transformation | Flexible welding unit, flexible and intelligent assembly line of hydraulic jacks, spraying automation unit, automatic production line of cylinder head forging, construction of intelligent inspection platform and construction of intelligent storage system. |
| 3             | Factory information transformation | Data interface, MES system, information processing system. |

The project will be upgraded and upgraded in three phases: the first phase plans to focus on the construction of intelligent flexible welding manufacturing units, and the preliminary construction of the MES information system is completed through the intelligent workshop of the leading product; the second phase plans to build the hydraulic jack flexible intelligent assembly line, Spraying automation unit, plate cutting automatic sorting line, cylinder head forging automatic production line, intelligent detection platform and intelligent storage system, and on the basis of the first phase of the basic information platform, continuously improve the integrity of the information module, and build the entire plant area informatization ring network, and set up a process research and development center, a dedicated control system and a precision electrical integrated production department; Phase III will intelligently upgrade the corresponding peripheral auxiliary systems on the basis of highlighting the main products and secondary products to achieve the entire Comprehensive intelligent transformation of the plant area, and research and development and production of new products.

The main contents of the project construction are:

1) Technical upgrading of existing production equipment in the production plant, and new intelligent automation facilities, making the company a leading domestic high-end mining equipment manufacturing platform;

2) On the basis of existing products, transform and upgrade to large-scale agricultural machinery and equipment;
(3) On the basis of existing welding equipment, add 2 welding units and 8 manipulators, and perform flue gas treatment to make the welding unit safe, flexible and intelligent, and better meet the needs of enterprises;

(4) For the hydraulic jack production workshop, change its extensive assembly process, increase the linear assembly line, upgrade the original ground operation method to the table operation, improve work efficiency and labor intensity;

(5) New painting robots are used to change the production method of manual painting in the original painting room, to enhance the painting effect, improve the working environment of workers, and reduce production costs;

(6) The cylinder head forging is equipped with an automatic feeding machine and a robot (with a manipulator) to adjust the relative positions of the intermediate frequency furnace and 3 presses and the double-disc friction press. Two robots are selected to realize the automatic feeding machine to the product molding. Automated production

(7) Establish an intelligent warehouse system with a material management platform as the core. Through the RFID Internet of Things radio frequency combined with barcode technology, it can effectively improve the precise management of storage locations and realize automatic tracking management of the entire process of logistics;

(8) On the basis of the existing hydraulic support test and detection equipment, transform it and add related supporting testing equipment, strengthen product testing methods such as electrical control, reliability, and environmental testing, and establish a hydraulic support performance testing center;

(9) In the context of the country's full implementation of big data applications, set up a dedicated control system and precision electrical integrated production department and process research and development center to develop a dedicated control system for mining equipment, improve the control and feedback performance of existing products, and actively explore the possibility of combining mining equipment and big data to improve the core competitiveness of enterprises;

(10) Add MES software and the construction of different informatization modules to form an informatization ring network for the entire plant area and realize a comprehensive intelligent transformation of the entire plant area;

(11) Promote the concept of lean management in an all-round way, organically integrate the idea of lean management with lean production, carry out standardization operations, establish a production mode with a cycled production line, build a sound, scientific and systematic management system, and improve the core competitiveness of enterprises.

7. Overall automation architecture of intelligent coal machine plant

7.1. Improving the innovation capacity of the equipment manufacturing industry
In accordance with the "Made in China 2025" plan deployed by the State Council, the Coal Machinery Association is committed to promoting the development of the coal machine equipment industry to a higher level and strengthening the industry's innovative development. Through national special projects and fund support to strengthen human resource reserves, research and development of key core technologies, do a good job of key coal machine topics or new product development, and do a good job of reviewing, appraisal and promotion of new topic and new product technologies, and improve coal machine manufacturing innovation. System, extract key technologies, accelerate the transformation of achievements, and promote the industrialization of achievements.

7.2. Promote the integration of informatization and industrialization in the equipment manufacturing industry
Accelerate the integration of next-generation information technology and equipment manufacturing and manufacturing technology, and consider intelligent manufacturing of coal machine equipment as the focus of deep integration of informationization and industrialization. Focus on the development of various coal mining intelligent products, organize comprehensive mining robots with automatic sensing
and intelligent machine decision-making, intelligent unmanned comprehensive mining production lines, automatic control systems for coal production at intelligent fully mechanized mining faces, and underground mining application software for the coal industry to achieve Real-time interaction and intelligent control of ground personnel, equipment and underground mining conditions promote the intelligent production of mines.

7.3. Build China's own coal machine brand
Making China's own coal machine brand is an inevitable move of China's coal machine enterprises during the "Made in China 2025". It is the way to promote the coal industry to eliminate backward production capacity and realize the healthy development of the coal machine manufacturing industry.

7.3.1. Accelerate the quality of coal machine equipment products. The coal machine industry has developed rapidly in the past decade. From the perspective of domestic and foreign coal machine markets, the products produced by China's coal machine manufacturing industry have a certain export value, but compared with the international advanced level, the reliability of China's coal machine equipment system there is still a big gap between qualitative and quantitative, especially in the production of open-pit coal mining equipment.

7.3.2. Consolidate the foundation for product quality development. Formulate equipment manufacturing standards that are in line with international advanced standards. Establish a high-level mining product quality supervision and inspection center, improve the certification level of coal mining products, and promote international recognition, and reach an effective self-discipline standard and convention with the international advanced level combined with the actual conditions of our coal mining industry.

7.3.3. Promote brand building and build a Chinese coal machine brand. Guide enterprises to formulate a brand management system, strengthen product quality management around innovative production and manufacturing, provide customers with a service model from design to manufacturing, after-sales maintenance, repair, and accessories integration, and consolidate the foundation for brand development. Build China into the world's largest coal machine equipment manufacturing base with the best coal machine product quality, the largest variety, and a complete set of machine capabilities.

7.4. Promote green manufacturing to make China's coal equipment manufacturing industry sustainable
Fully respond to the national low-carbon economy concept of energy conservation and consumption reduction. In the process of building China's smart manufacturing, we must comprehensively consider the consumption of the environment and resources, and pay attention to energy conservation and emission reduction in the production process of coal machinery equipment. Green manufacturing should fully consider the life cycle of coal machine products. From coal machine design to production, transportation, and scrap, raw materials and energy must be considered. Based on advanced manufacturing technology and green production, recycling of used coal machine products can be considered. Remanufacturing, reused remanufacturing technology to support the construction of green mining and ecological mining.

8. Conclusion
The coal mining industry is a technology-focused enterprise. We must work hard to promote the construction of an innovation system that takes core technology as the main body, market-oriented, and combines production, education, and research, deepen system reform. In recent years, with the gradual improvement of the coal situation, the coal machine manufacturing industry should vigorously promote the construction of digital and intelligent factories, with the goal of flexible manufacturing in the industry, and orderly implementation of intelligent manufacturing product structure design and
development, intelligent production lines, and intelligent Production modules such as logistics, intelligent scheduling, informatization management, and lean management change the traditional extensive development model with high investment and high output, and achieve staged results such as staff reduction, quality improvement, and efficiency improvement, and realize the transformation and upgrading of the coal machine manufacturing industry. High-quality sustainable development.

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