Design of Real Time Monitor System of Manufacture Process of Iron and Steel Industry Based on New Style Sensors

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Abstract

The real-time monitoring system based on new sensor of manufacturing process about iron and steel industry is proposed after some of the negative factors find in the production process and yard management in iron and steel company are analyzed. First a needs analysis is conduct, the overall system structure based on the analysis is given and each subsystem is described in detail and design. The system helps to enhance the production process management and reduce environmental load, to enhance the energy significantly and emissions control efforts, to improve equipment utilization and manufacturing efficiency, to promote vigorously the depth of integration between information technology and industrialization.

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1. Introduction

Chongqing iron and steel (Group) limited liability company (hereinafter referred to as "CISC") is a century-old large-scale iron and steel enterprise, which is Chongqing's largest state-owned industrial enterprises to Iron and steel industry as the main axis of industrial development and carefully cultivate non-steel industry is important as the main and auxiliary. Energy is the "blood" in the enterprise production process, energy and material consumption in the manufacturing process is one of the key factors of sustain and healthy development for CISC. CISC is not only as the pillar of economic development of Chongqing enterprises, but also as the energy consumption of large enterprises. The higher energy consumption not only causes the high cost of steel products, but also means more pollution and emissions. In this paper, CISC has problems in the metallurgical control system, such as automatic flow control between the low level, resulting in energy consumption, a large impact on the environment,

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etc. The real-time monitoring system based on new sensor of manufacturing process about Iron and steel industry has been proposed, system has full use of the application of the wireless industry, and industrial sensors, industrial Ethernet networking technology in the manufacturing process materials of production, energy consumption, materials, environmental protection to enhance production, improve energy efficiency, reduce environmental impact, build a resource-saving and environment-friendly enterprises, to play a good role model for enhance the manufacturing efficiency and energy savings.

2. The system requirements analysis

Currently, CISC has many problems in Management and control system: key control technology has fallen behind, which leads to low production efficiency; the control of production equipment is limited to a single point of control for large-scale equipments, there is a "solitary point control" issue; control system is decentralized, there is a data transmission problem during Information integration and information transmission process. Collaboration is difficult to control spatial dispersion for the remote equipment, aerial equipment; there is existence of control "vacuum" Problem.

The monitoring system has been proposed based on the number of problems existing in CISC currently, combined with the needs of the use of new factories in the manufacturing process control sensor technology to enhance the ability of real-time, Fully use of the advantages that new sensor technologies can address the production process of the steel industry processing product width, thickness, temperature and other indicators of real-time monitoring and management. The monitoring system can solve these problems such as intelligent control and " BF - BOF - hot rolling " efficient compact intelligent control and other issues, in order to achieve "jar system" between hot metal and converter steel, and can solve such difficult problems of running awareness and remote real-time transmission of information including electricity, gas, water and other major energy producing medium in The production process, also can solve the problems about the real-time monitoring of the environment and the material status of the location of production yard, can solve the problems of various emission sources and Pollutions of steel production process even more.

3. The general description of the system

On the basis of existing information systems in CISC new plant Integrating use of sensor node design, sensor network networking technology, sensor network and communications network information fusion technology, the region-wide manufacturing process monitoring support system showed in Figure 1 is build including the production process tracking system, manufacturing process control subsystem energy consumption, production materials and manufacturing process control subsystem field environmental monitoring subsystem.

Fig.1. overall framework of the monitoring system based on new sensor of the manufacturing process in the steel industry
4. The system functional design

4.1. The production tracking system

In the steel production process implementation dynamic monitoring of the indicators of products is particularly important, the inspection and laboratory sampling and testing automatically is implemented by Radio Frequency Identification (RFID) devices, infrared sensors and other sensors and computer communication networks, which leads to improve product quality, to optimize the production process, in order to achieve the production process of things, to improve the ability and level of the process monitoring in production line, real-time data acquisition, monitoring equipment and material consumption monitoring, also to improve the level of the intelligent control of the production process. The tracking system is implemented by application of new high temperature RFID, the intelligent control problem about "blast - furnace - hot-rolling" compact and efficient is studied in order to achieve the converter "jar system" between blast furnace hot metal and steel. By Integrated use of wireless sensor technology such as wireless bar code, RFID radio frequency identification devices, the wireless data transmission cars are configured in order to solve the problems of the remote real-time transmission of logistics management, to achieve the real-time tracking and control of the logistics in the products. The production tracking system architecture based Networking technology is shown in Figure 2.

![Diagram](Figure 2)

4.2. The power management subsystem in manufacturing process

The energy management subsystem based on the Industrial sensors networking technology can achieve the real-time media monitoring, management and scheduling about major energy producing such as electricity, gas, water. The gas balance is optimized, which can reduce gas emission, improve environmental quality, and reduce energy consumption and increase labour productivity and energy management. The energy management subsystems based on networking technology are linked with the underlying device by sensor networks, are connected to the mobile communication network through the gateway, then are communicated gateway into the new backbone, are integrated with Field bus networks, intranets. The architecture is shown in Figure 3.
Manufacturing process energy management subsystem can be divided into basic energy management, integrated monitoring and management of balance scheduling, specific functional division is shown in Figure 4.

4.3. The production yard monitoring subsystem

Through Integrated use of wireless sensor technology such as wireless bar code, RFID radio frequency identification devices, the centralized management of raw materials is achieved, in order to short the transport distance of raw materials, reduce transit times, so that process is more perfect, smoother. The application of the internet of things technology can improve the raw material pile height so that it can improve space utilization and the operating rate of production. Raw material management automation can accurately knowledge the operating time, improve equipment efficiency, avoid equipment idling energy. The automatic sampling system can accurately knowledge components of raw materials in order to ensure the quality of the raw materials and fuel into the furnace, make the best use of things. Setting the sensor measuring device can improve labor productivity, reduce energy, reduce material consumption and improve the management. Setting automatic detection devices of environment of raw materials market can
real-time monitor yard environment and take measures of water dust, dust and other enclosed dust and mechanical to control dust pollution on the environment by monitoring results. To achieve automatic control of operating equipment can solve the issues of automatic walking, accurate positioning, and real-time information delivery conditions of operating equipment according to production and process requirements and under the direction of the host computer commands. It can be achieved automation management of raw materials and the real-time monitoring their location and status \(^6\). The production yard monitoring subsystem is shown in Fig 5.

4.4. The environmental monitoring subsystem

The iron and steel industry pollution control real-time monitoring solution based on industrial sensor networking technology is researched, a variety of sources of pollution and key indicators of pollution control various aspects are real-time monitored by integrated use of The Internet of things technology for steel production process. The wireless sensing devices are installed in the iron and steel enterprises outfall, corporate emissions data are real-time monitored, sudden environmental pollution accidents can be prevented. Air pollution data are collected by deployment monitoring network in key pollution area in order to warn timely in case of emergency. The architecture of environmental monitoring subsystem based on networking technology is shown in Figure 6\(^7\). A variety of sources of pollution and key indicators of pollution control various aspects are real-time monitored by integrated use of The Internet of things technology for steel production process. It can not only warn timely but also shut down the operation of the equipment remote in case of emergency in order to prevent sudden environmental pollution accidents\(^8\).
5. Conclusion

In this paper, based on the in-depth study of industrial sensor technologies such as integrated steel production process monitoring, the real-time monitoring system based on new sensor of manufacturing process about iron and steel industry has been designed, which is to optimize the process, improve equipment efficiency and reduce energy consumption and pollution emissions. Greatly reduce refining time, to achieve the automation, high efficiency and scientific management of the process from data collection to process monitoring to analysis to management and control, to significantly enhance energy and control efforts and vigorously promote the depth of integration between information and industrialization, to improve equipment utilization and manufacturing efficiency, reduce environmental impact, to bring significant economic and social benefits for CISC, and to make a major contribution for the city’s promotion the use of industrial sensor such as industrial sensing in the manufacturing process of industrial production processes.

References