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The Sensor Collaboration Structure of Industrial 4.0

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Abstract

As information and technology grow up globally, the business should look for the optimal productivity efficiency and add smart management to maintain the company's interests and value. In order to achieve the smart productivity, vast businesses pay lots of attention to invest in industrial 4.0 and change their business model. In this research, the sensor collaboration structure will be proposed and established to connect the information base and thing base. Human can make decisions and communicate between the physical domain and the cyber domain. In the physical domain, the sensors can gather the data from the machine, the production line, the factory and the product. By sensor collaboration, the signals and information can transfer quickly and simultaneously in the cyber domain. Through the networking between information base and thing base, decision makers can easily predict, judge and handle the tasks. As a result, information base, thing base and decision makers can become a triangle system to achieve the vertical integration and level contact.

Keywords: industrial 4.0, sensor collaboration, physical domain, cyber domain

1. Introduction

Nowadays, the pursuing goal for the manufacturing industry is to establish the smart factories. The first industrial revolution is to execute machines instead of human to conduct large-scale production. The second industrial revolution is to add the concept of assembly line for improving production efficiency. In the third industrial revolution, with elements of electronics and information technology, the production costs are declined. With the development of globalization, the factory must be supplemented with intelligent management to facilitate more rapid changes in the industry pulsation. Combining with the advantages of three previous industrial revolution, the industry 4.0 is coming to search for the highest efficiency of production resources and to achieve the purpose of the intelligent production. In this paper, the sensor collaboration structure will be proposed for the smart factory.

The concept of industrial 4.0 has been popular in Europe, especially in German manufacturer industries. Smart machinery can continuously share inventories, problems information and demands through the internet, so the production process and lead time can be flexibly adjusted. Cyber-Physical Production Systems (CPPSs) can not only connect machines with each other, but also create the whole values of the stages in the product life cycle. Sensors and control elements make the machines, factories, transportation, internet and humans together [1]. Fig. 1 shows the history of the industry revolution.

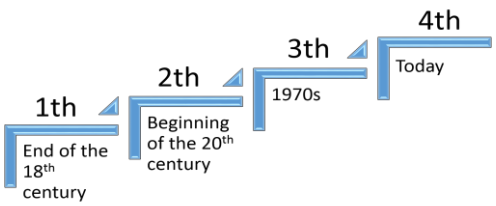

Fig. 1 History of the industry revolution

2. The Architecture of Industrial 4.0

The architecture of industrial 4.0 which has the vertical integration of the smart production system, the horizontal integration of the networks, through engineering interaction, and exponential technologies.

2.1. The Vertical Integration of the Smart Production System

CPPSs make the factories vary their inventories and demands flexibly. Smart factories

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establish customized and personal production through data integration and smart sensing techniques. CPPSs also promote the automation management, maintenance management and resource connection.

2.2. The Horizontal Integration of the Networks

The horizontal integration which is an optimized real-time networks can create the higher value and more flexible for problem solving. The internet based production system can provide the integrated platform for logistics, inventories, production, marketing and sales between in-house and outsourcing.

2.3. Through Engineering Interaction

Industrial 4.0 has a cross-disciplinary through engineering to connect overall supply chain from products to customers. Data and information can be obtained in each stage of the product life cycle to establish the model from the prototype to the end product.

2.4. Exponential Technologies

Artificial intelligence (AI), advanced robot and sensing technology can make the production personalized and flexible. AI can not only analyze big data, design the more flexible path for the automated guided vehicle (AGV) and save costs of the supply chain management (SCM), but also enhance the cooperation between human and machinery. In addition, the 3D printing provide the new solution for the production mode to reduce inventories and lead time for the firm.

3. Conclusions

In this paper, the proposed architecture of industrial 4.0 has the vertical integration, the horizontal integration, through engineering and exponential technologies. The sensor collaboration for industrial 4.0 can collect and interact with human and machinery. Managers can correctly make a decision by the cyber-physical system.

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References

[1] X. Yue, H. Cai, H. Yan, C. Zou, and K. Zhou, “Cloud-assisted industrial cyber-physical systems: an insight,” Microprocessors and Microsystems, vol. 39, no. 8, pp. 1262-1270, 2015.