Research on Cloud Manufacturing Overlay Network Technology Based on Web of Things

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Abstract. In recent years, the combination of the Web of things and various manufacturing technologies has become a hot issue in academia. The emergence of intelligent manufacturing technology based on the Web of things has been repeatedly proposed by various industrial enterprises and researchers. On this basis, a new manufacturing mode of cloud manufacturing technology is proposed. It can be seen that the Web of things technology combined with cloud manufacturing is the key technology to realize intelligent manufacturing thinking in today's society. This paper summarizes the overall architecture of the Web of things coverage network through a brief analysis of cloud manufacturing technology, and finally comes to a conclusion.

Keywords: Web of Things, Cloud Manufacturing, Overlay Technology

1. Introduction

With the continuous update and innovation of computer technology, the real-time interaction between mobile devices and embedded systems has brought a revolutionary impact on our daily life. The integration of logistics and computer technology is called the Web of things technology. Internet remote monitoring and intelligent control equipment through wireless sensors is also known as Web of things equipment[1].

However, the sudden growth of Web of things devices has brought enormous pressure on the computing power and storage capacity of electronic devices. In order to alleviate this kind of work pressure, people put forward the concept of cloud manufacturing technology. It can combine cloud computing technology and Web of things technology into a whole. At present, the technology of cloud manufacturing overlay network based on the Web of things has become the main research trend in the academia[2].
2. Research status of cloud manufacturing technology

2.1. Definition and connotation

Cloud manufacturing can also be called smart cloud manufacturing technology. It is a branch of the new pattern of intelligent manufacturing. Cloud manufacturing is based on the existing network system, user-centered, with the help of new manufacturing methods to help users access manufacturing resources and manufacturing capabilities at any time. Its connotation mainly includes the sharing of manufacturing capacity and the cooperation of socialized human resources. It can be applied to the industrial manufacturing of enterprises. It can also be applied to the structure of the overlay network of the Web of things[3].

2.2. Key technologies related to cloud manufacturing

The overall technical means of cloud manufacturing is standard integration technology. Integration technology mainly involves the definition of architecture and model. It includes various technical and economic problems such as manufacturing resources and profit model. In addition, cloud manufacturing also has the ability to perceive technology and service-oriented technology. Cloud manufacturing can sense the data exploration process of manufacturing technology. It can selflessly share manufacturing resources to every user[4].

2.3. Web of things overlay technology based on cloud manufacturing

The architecture of the Web of things is based on the physical network. It can use the existing virtual network to provide people with comprehensive services of logistics network. At present, there are two aspects in the research of overlay network. One is the construction of overlay network. The other is the establishment of the communication system of the overlay network.

3. Structure and communication of cloud manufacturing overlay network based on Web of things

3.1. Classification of peer-to-peer overlay networks

Peer to peer coverage networks can be roughly divided into two categories. One is a structured coverage network. The other is the unstructured coverage network. Structured overlay network has strict network structure. It can provide people with specific network information of each node (see Table 1). Unstructured overlay network belongs to scale-free network structure. The number and degree of nodes are very small. The information of each node represents the information of a part of the network[5].

| Table 1. Performance comparison between structured and unstructured overlay networks |
|---------------------------------------------------------------|
| Unstructured overlay network | Structured overlay network |
| Topology | No specific topology | Specific topology |
| Node connection | Random connection | Rule connection |
3.2. The architecture of Web of things coverage network and the choice of communication

The architecture of Web of things should provide uniform service capability and call interface capability. Therefore, we can choose the style of rest architecture as the construction principle of its architecture. In the process of covering network communication, a series of related protocols are essential. According to today's research, we can adopt the communication mode of IETF and COAP.

4. The construction of cloud manufacturing coverage network based on the Web of things

4.1. Requirements for establishment of system structure

Before designing and building the structure of overlay network, we should meet the basic requirements of overlay network system. It includes operability, virtualization, service and modularity. Operability refers to the relationship that different devices and systems can establish operation. Virtualization refers to the virtual environment simulating the real physical engine. Service and modularity refers to the division of module work can better serve people's needs.

4.2. System structure

The lowest layer of the system structure should be the resource adaptation layer. It can judge the control and communication mode of data acquisition to adjust the input and output of resources. The middle layer of the system structure should be the device layer. It can realize efficient query of resources. The top layer of the system structure should be the application layer of cloud manufacturing, which can help users find the corresponding service-oriented applications.

4.3. Description of system model

In order to describe the coverage network of the Web of things more accurately, we can use a formal method to describe the basic elements of the system structure. In this paper, we plan to adopt a simple equation to describe overlay network. The whole stage construction of overlay network is as follows:

\[ NO_{pe} = \bigcup_{t=1}^{T} St(K_{st}) \]  

\( NO_{pe} \) is a collection of ID for all resource objects. \( T \) is the set of practice stages. \( K \) is the collection of query information of requirement resources.

5. Communication transformation scheme based on IP network

The communication transformation of overlay network can improve the operation speed and communication stability of the system. The specific transformation steps are as follows:

| Net-maintenance | Dynamic recovery network | Additional network overhead |
|------------------|--------------------------|----------------------------|
| Effect           | Poor performance         | Excellent performance      |
| Security         | Vulnerable to attack     | Not vulnerable to attack   |
5.1. Installation of communication chip

Based on the implementation of WPAN protocol, we can add protocol supporting communication chips for manufacturing equipment. It should be noted that the addition of communication chips requires the support of IP network and equipment manufacturers.

5.2. Construction of low consumption communication network

In the process of network communication, we can use wireless sensor network technology to build a number of local low-power communication networks. It can provide more network services with lower consumption. It can also support multi hop communication.

5.3. Development of communication application

We can develop corresponding new communication interface according to the design principle of communication interface. On this basis, we can develop applications related to COAP communication technology. Two kinds of different communication portals can form a fast WEB communication service.

6. Conclusion

Web of things is a powerful information technology based on the progress of the Internet. The application of cloud manufacturing technology has an inseparable relationship with the Web of things technology. The emergence of cloud manufacturing coverage network based on the Web of things can meet the production needs of today's manufacturing industry. It can improve the production efficiency of manufacturing products and help people real-time monitor the relevant information of production nodes.

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