Research Based on Data Processing Technology of Industrial Internet of Things

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Abstract. With the increasingly wide application of Internet of Things technology in the industrial field, Industrial Internet of Things provides a viable and convenient service for the development of intelligent industry, meanwhile more and more countries pay attention to the development of Industrial Internet of Things. The data of Industrial Internet of Things have features such as massive polymorphism, dynamic heterogeneity, relevance, real-time etc.

These features become resistance in the process of data to create value. This paper explores the issues and challenges of data of Industrial Internet of Things, and studies data processing technology deeply. It provide some help to improve data management of Industrial Internet of Things.

Keywords: Industrial Internet of Things · Data · Data processing technology

1 Introduction

With the development of computer technology, industrial economy and communication technology, especially the development of Internet of Things technology which is widely used in the field of industry, these will change the modern industrial production process, management mode and management concept. Industrial Internet of Things will bring another information revolution to modern industry. In recent years, the rapid growth of new industry requires more and more intelligence of industry. Industrial Internet of Things provides a feasible and convenient service for the development of intelligent industry. At present, the massive data mining and massive using indicates that the era of big data has come. More and more countries pay attention to the development of Industrial Internet of Things. The data of industrial Internet of Things have features such as massive polymorphism, dynamic heterogeneity, relevance, real-time etc. These features become resistance in the process of data to create value. Big data will become the main way and key elements of industrial productivity and competitiveness, thus data processing technology is one of the key technologies of industrial Internet.

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2 Related Concepts: Industrial Internet of Things

Internet Of Things shorted as IOF is the object and object connected to the Internet. At present, industrial IOF has not yet clear and accepted definition. It mainly refers to the intelligent terminal, mobile computing model, ubiquitous mobile network communication applied to all aspects of industrial production. It coordinates data analysis and action, promotes industrial efficiency, and improves manufacturing efficiency so as to realize intelligent industry. It is an industrial system that connects the digital world with the physical world through sensors and actuators. Industrial IOF needs to meet the following three requirements: the first is time accurate synchronization requirements; second is the accuracy of communication; third is the high adaptability of industrial environment.

3 Characteristics of Data in Industrial Internet of Things System

The architecture of Industrial Internet of Things is divided into data acquisition layer, data transmission layer, data integration layer and data application service layer. It plays an important role in the intelligent industry in the whole work system. Data processing will be one of the most important technologies for Industrial Internet of Things, so understanding the characteristics of massive data for Internet of Things, is the key to deal with big data of industrial Internet of Things. The data of industrial Internet of Things have features such as massive polymorphism, dynamic heterogeneity, relevance, real-time etc.

3.1 Massive Polymorphism

The system of industrial Internet of Things, usually contains multiple wireless sensor networks which contains very many sensor nodes, and the amount of data collected by sensor nodes is massive. Sensor nodes in the sensor network can be judged by the pressure, vibration, sound, etc., so the data obtained are various. Different data have different formats, units, precision, etc., thus the data of industrial Internet of Things is dynamic.

3.2 Dynamic Heterogeneity

There are some differences in the physical material and system design in the sensor system of industrial Internet of Things, which causes the data that produced in the industrial production process to be different in quantity, progress and so on. Data measured by different sensors may also vary at different times. Dynamic heterogeneity is an important feature of industrial Internet of Things data. This feature leads to industrial Internet of Things in data storage mode is difficult to unify.

3.3 Relevance

The data of industrial Internet of Things is not independent, and it have a certain connection. The data acquired by industrial Internet of Things in the production process and

data attributes belong to a whole not a single one can be omitted. There are many correlations between data in space, time and other dimensions, therefore, in industrial production, data transmission, storage, use, such as the process must pay attention to the integrity and accuracy of data attributes.

3.4 Real-Time

The data real-time requirement is prominent in the application process of industrial Internet of Things whose system requires high real-time information for the sensor nodes of the data acquisition. Data real-time performance ensure that important data get more transmission time in the transmission process, thus data enables information to be aggregated faster to nodes, faster integration, and faster analysis and conclusions, so the system can make all kinds of decisions faster according to these conclusions.

Wireless sensor needs to complete the task of sensing, transmission, coordination and other tasks in the industrial Internet of Things system. In the whole process, it will produce massive data, the more data collected, the more junk information will be. We study the data processing technology of industrial Internet of Things according to different industrial production demand.

4 The Data Processing Technology of Industrial Internet of Things

The data of industrial Internet of Things have features such as massive polymorphism, dynamic heterogeneity, relevance, real-time etc. These features make data processing need to solve the following the problem of key technologies.

4.1 The Data Storage Demand of Industrial Internet of Things

The data adopted by the industrial Internet of Things is real-time and massive. Data from sensor nodes, variety of intelligent terminal equipment and generated by variety of physical objects in the production process must be transferred to control center. data is collected, analyzed, and calculated by using data mining and analysis tools, and it is supported and serviced ultimately. The storage of industrial Internet of Things data needs the support of database, data warehouse, network storage and cloud storage technology. The research on storage, retrieval and query of mass data in industrial Internet of Things is beneficial to data acquisition and application. There is a big difference between wireless sensor database management system and traditional database system in the industrial Internet of Things system. Major expression is the in following few aspects.

First, in the industrial Internet of Things system, wireless sensor nodes have only limited capacity and computing power, and its function is limited by battery capacity and network routing. Traditional database system can query and process database independently, not affected by computer network distributed process communication.

Second, in the industrial Internet of Things system, data sensed by ireless sensor node can not be sent back to the central processing node, and it must use certain control

mechanism and method to analyze the data, and then transmit the data, thereby reducing the amount of data transmission.

Third, in the industrial Internet of Things system, it must be "data centric". If some wireless sensor nodes fail due to power exhaustion, other nodes should be rebuilt in accordance with the requirements of ad hoc networks, and data transmission, data fusion will also change, so database management systems must adapt to these changes while the traditional database system does not appear this situation.

4.2 The Data Storage Technology of Industrial Internet of Things

4.2.1 Storage Mechanism

Data storage mechanism of industrial Internet of Things adopts two forms: storage mechanism and traction mechanism. Each data node provides data to the global view for providing a global view. Through global view, we can quickly locate the required nodes and reduce query time. Individual network node commonly need use of non relational technology for data storage. To Two kinds of data of temporal flow and spatial flow of industrial Internet of things, we can file data by creating traction algorithms automatically and find the best solution by using traction technology.

4.2.2 Data Management System Architecture and Model of Industrial Internet of Things

At present, most of the industrial IOT database management systems adopt semi distributed structure according to the data characteristics of wireless sensor nodes. There are two main data models in Wireless Sensor Networks: one is to perceive the data as a distributed database; another is to consider each wireless sensor network as a distributed database system. Semi distributed structure is generated under the combination of traditional database technology and network technology, and its physical space is dispersive. Data are distributed in various nodes of wireless sensor networks, but it has unity in logic and data is independent. Semi distributed database management adopts control mode and global control centralized, decentralized or decentralized.

4.2.3 Data Query

Data query of industrial Internet of Things relates to different types of data objects and data size and scope is very extensive. The data system of industrial IOT is composed of several independent network nodes which has a different storage mode. Because the amount of data is increasing, and the heterogeneity and interoperability exist in real-time data, data query must maintain the integrity of the data.

Data query language requires structured data query, and it can be extended to XML and can inquire web pages, documents, etc. Stored data can be stored in time series that helps to improve query performance and response.

4.3 The Data Fusion Technology of Industrial Internet of Things

Wireless sensor network is an important part of the perception of industrial Internet of Things. Because of its constraints of energy, storage capacity and transmission energy, it consumes the most energy in the data transmission process, therefore, the data must be analyzed, integrated and then transmitted by a certain control mechanism and method in the transmission process. Thereby, the transmission of data quantity is reduced. Data fusion process (As shown in Fig. 1).

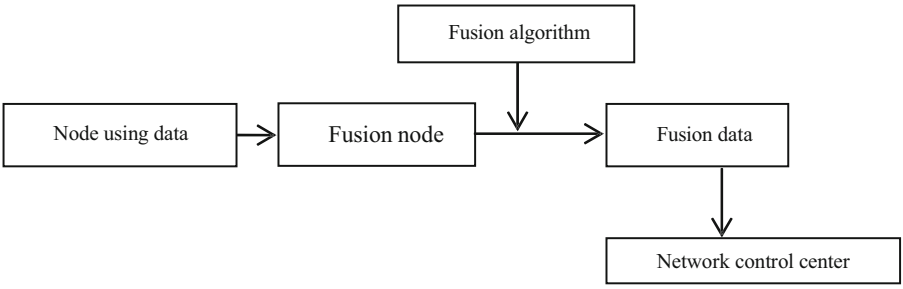

Fig. 1. Data fusion process

Data fusion technology involves a wide range of methods. According to different rules, there are many classification standards. There are three kinds of data fusion technologies in industrial wireless sensor networks: classification according to the data content before and after fusion, or classification according to the relational of data semantics before and after data fusion, or classification according to the level of fusion operations. This paper studies the technology of data fusion in industrial Internet of Things according to the different level of fusion operation.

4.3.1 Data Level Fusion

Data level fusion named as “pixel fusion” is the primary data fusion. Data acquired by sensor is data oriented fusion that usually depends on the type of sensor and that is a combination of pixel classification. Its working principle is that immediately expand data fusion in its initial state after sensor nodes collecting data, and then classifying and discriminating the collected data for reducing redundant information. Data level data fusion diagram shown in Fig. 2. Data fusion can maintain data integrity, and the obtained data is more detailed and accurate than the obtained data from other methods, however, the channel bandwidth and energy consumption in the data transmission are very high.

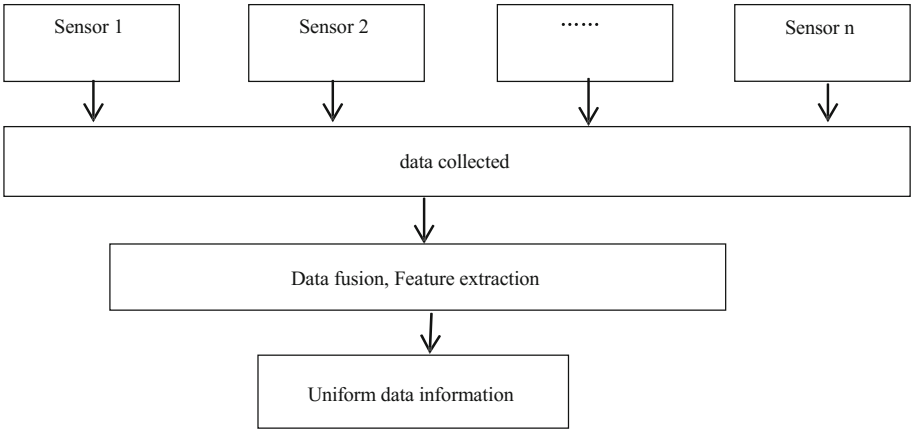

Fig. 2. Data fusion diagram

4.3.2 Feature-Level Fusion

The feature-level fusion of data is the fusion of monitoring object features, through feature extraction, the data is represented as a series of features reflecting things. Its working principle is that sensor nodes of industrial Internet of Things collect data information of an object. According to the specific situation, the characteristic data get by sensor node is extracted, and forming characteristics, providing data information description according to certain circumstances. Feature-level data fusion diagram shown in Fig. 3. Through the feature-level fusion technology, the data collected by the sensor node only needs to transmit the extracted part, that can greatly reduce the amount of information transmission and shorten the transmission time. Feature-level data fusion applications require certain regularity, and we need to clear the distribution of nodes of industrial Internet of Things for purposeful division, but each node is randomly distributed that causes the feature-level data fusion applications to be limited accordingly.

4.3.3 Decision-Level Fusion

The decision-level fusion is application oriented fusion whose working principle is similar with feature-level data fusion according to application requirements. The sensor node takes the characteristic data to an object in the concrete situation and refines the information to form a vector of features. Decision-level fusion operations include data feature parameters, and identifying and classifying characteristic parameters, and dividing the provided data information. That allows you to obtain decision information that satisfies application requirements through logic.

In the industrial Internet of Things, decision-level fusion data affects the final decision, that has a high degree of flexibility, good fault tolerance, etc., but decision- level fusion is based on specific criteria and programs. Data fusion needs to continue to study from practical issues, and it makes the fusion results more in line with the actual requirements.

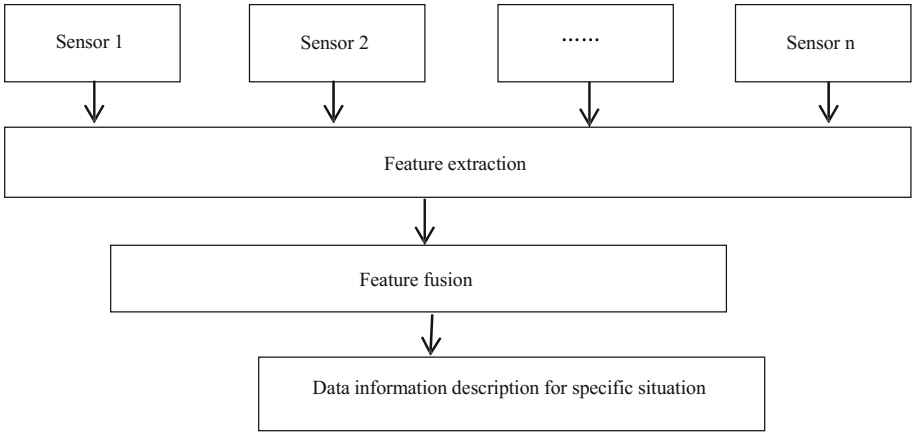

Fig. 3. Data fusion diagram

5 Conclusion

In recent years, the rapid development of new industry requires more and more intelligence of industry. Industrial Internet of Things provides a viable and convenient service for the development of intelligent industry. There is a large amount of data in industrial Internet of Things that will cause waste of resources in the system transmission process. The data of Industrial Internet of Things have features such as massive polymorphism, dynamic heterogeneity, relevance, real-time etc. These features become resistance in the process of data to create value. This paper explores the issues and challenges of data of Industrial Internet of Things, and studies data processing technology deeply. It provide some help to improve data management of Industrial Internet of Things.

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