Theory and Practice of Science and Technology
2025, VOL. 6, NO. 1, 162-165
DOI: 10.47297/taposatWSP2633-456931.20250601

The Integrated Development of Industry 4.0 and Internet of Things

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ABSTRACT

The Internet of Things plays an important role in industry 4.0, and is one of the supporting technologies. Its identification technology, embedded system technology Internet of Things data and other key technologies can be applied to the whole process of industrial production, manufacturing, transportation, sales, etc., which helps to promote the development of industrial production automation and drive profound changes in production methods and productivity. It is of great significance for the sustainable development of the industrial field. This paper will deeply explore the integrated development of industry 4.0 and Internet of Things, and put forward feasible schemes to give full play to the value of Internet of Things and promote the industrial production to be more flexible and efficient.

KEYWORDS

industry 4.0; Internet of Things; connectivity

The integrated development of industry 4.0 and Internet of Things helps to improve the production efficiency and quality, promote the industrial upgrading and innovation, enhance the comprehensive competitiveness of enterprises, and make the factory equipment and management operation always in the best state. Therefore, it is necessary to fully integrate the two to build a new development model, realize the intelligence, automation and digitization of factories, and form a complete chain including customized needs, terminal services, smart factories, smart products, smart logistics, etc.. In this process, vertical integration, end-to-end integration and horizontal integration will be realized, and the ubiquitous intelligent control system, embedded terminal system, communication facilities and sensors will be formed into an intelligent network through CPS, in order to enable interconnection between machines and humans, between machines, between humans, and between services, and to achieve high integration between enterprises, within enterprises, and even of the entire value chain, thus bringing great potential and opportunities for industrial development.

1 The Concept and Development of Internet of Things

Internet of things (IoT) is a new generation of information technology that connects humans with things and things with things. It mainly senses and identifies the physical world by using a variety of intelligent devices and perception technologies. And it connects the calculation, processing and transmission of information through the Internet, so as to realize the full sharing and interaction of information. The Internet of Things mainly includes four levels. The first is the perception layer, which senses and recognizes objects, and collects information by means of automatic identification, sensing, radio frequency identification and other technologies. Meanwhile, it sends the information to the upper application through the communication template [1]. The second is the application layer, which mainly undertakes the tasks of collected information analysis, storage, summary and processing, and needs to present the information to users according to the service conditions. It can provide industry application services, big data application services, data mining services and mass storage services. The third is the network layer, also known as the transmission layer, under the support of the communication network, the Internet, the radio and television network and the satellite communication network, which transmits the information of the perception layer according to the needs and routes. The fourth is the total amount and application layer, which mainly undertakes the task of applying valuable data information to various intelligent platforms, so as to further promote the better development of related upstream and downstream industries.

2 Core Technologies of Internet of Things

The first is the embedded technology, which can fully and effectively integrate computer hardware, electronic technology, sensors, etc. to form a complete work chain including sensor information collection, analysis and processing information through embedded systems, and comprehensive application. The second is the wireless sensing technology. Compared with traditional sensor technology, the wireless sensing technology has an additional communication module,

which can support the interaction of information, and facilitate the upload of environmental information and equipment working information to the upper management.

And the wireless communication chip has the advantages and characteristics of low energy consumption, miniaturization, intelligence, etc., which meet the requirements of industrial Internet of Things intelligence, accuracy, and strong compatibility. The third is the architecture technology, which is a relevant service system built for the purpose of effective identification and collection of information. Based on a stable and efficient interactive service process, it can promote the efficient completion of tasks in the field of production and circulation. The fourth is the automatic identification technologies, which specifically include biometric recognition, speech recognition, IC card technology, wireless radio frequency communication technology, bar code technology, etc., and are mainly used for object scanning and login in logistics transportation[2].

3 The Integrated Development Paths and Strategies of Industry 4.0 and Internet of Things

3.1 Connectivity of Communist Devices

With the advancement of Industry 4.0, a large number of terminal devices are connected to the network system. According to the predictions from relevant institutions, there will be nearly 100 billion physical terminals by 2025. The original equipment connection mainly relies on physical cables. But because the factory environment is more complex, the number of access terminals is larger, the material consumption is larger, and the cost is higher, both the wiring in the early stage and the cable maintenance in the later stage are more difficult. The introduction and application of the Internet of Things provide new technical support to solve this problem. The network layer of Internet of Things includes wireless connection technologies, such as Zigbee, UWB, Wi-Fi, NFC and infrared communication. Therefore, enterprises only need to install a wireless communication module to complete the work of terminal equipment networking, thus having a real-time and comprehensive understanding of the operation of various equipment in the factory. At the same time, they can establish a complete enterprise information base to collect and integrate all kinds of data and information of the production line of the enterprise, and then find the problems existing in the equipment in time, and repair and replace the equipment, so as to avoid production failures, and affecting the production efficiency and finished product quality.

3.2 Smart Factory Safety System

The security application of the Internet of Things in Industry 4.0 is reflected in two aspects: personnel access control and terminal access control. Personnel access control means that only the personnel holding the RFID smart card can enter the enterprise, and the smart card will authenticate the personnel entering and leaving the enterprise. The secondary authorization is required in some core areas and key work areas of the enterprise to avoid irrelevant personnel entering the enterprise.

Video surveillance systems are also deployed inside and outside the factory for 24-hour monitoring. At the same time, through the integration the face recognition system, image recognition, and automatic alarm system, a complete monitoring system can be formed to achieve the linkage processing. Terminal access control is a powerful means of protection and has the function of "protection wall". Only after the physical address authentication and authorization are successful, can the network be accessed to prevent the intervention of unauthorized terminals.

3.3 Personalized Production

On the one hand, based on big data technology and Internet of Things, it can provide consumers with services to produce highly customized products to meet the diversified needs of different consumers. Through the use of big data technology to collect, analyze and process market statistics and consumer demand survey data, it can understand the actual needs and preferences of consumers, carry out personalized production, improve the market competitiveness, reduce inventory, and generate more economic benefits. On the other hand, the Internet of Things is applied to industrial production and manufacturing, automated production, and automatic identification and recognition of production materials, which can detect unqualified materials, supervise the input and use of materials, reduce the input of human resources, improve the production efficiency of all aspects of production, and effectively reduce the production cost of enterprises[3].

3.4 Intelligent Logistics

In the context of Industry 4.0 era, relying on intelligent logistics, users, consumers and factories are connected.

Intelligent logistics includes product storage, transportation and other links, in which the Internet of Things mainly plays the following roles. First, the raw material suppliers, manufacturers and sellers are locked in a closed-loop supply chain system. The current status of goods is obtained by using the two-dimensional code, REID, infrared video and other technologies, and is transmitted to the intelligent supply chain system in the form of data information. Then it is distributed to the management body and staff of each link after system processing, so as to achieve information sharing. The second is visual management, including the transportation of consumables required for manufacturing products, the delivery of finished products, etc.. For example, it can use the RFID, GPS/GIS to conduct the real-time monitoring of the location of logistics vehicles, product status, etc., so that users and managers can log in to the portal interface for query and management. It can assist manufacturers to form more accurate arrangement and delivery schedules of materials to improve logistics efficiency and reduce costs. Third, by attaching electronic labels to the surface of the target goods, it can track, record and process goods information, and achieve the integrated management of goods in or out storage, distribution and inventory.

3.5 Digital Twin

The emerging Internet of Things can provide a continuous real-time data stream, which enables manufacturers to create a virtual copy of a physical device or product, and form a digital twin model of any type of products. And then, the digital twin can be used for simulation operation and to transmit the resulting data to managers before actually building and deploying the device. It enables managers to understand the operation status of products under various conditions on the site, so as to timely learn and discover defects, accurately predict the results, improve the product quality, reduce the cost of simulating product recalls after leaving the factory, and promote the technology research and development, product innovation, and production quality and efficiency of the factory[4].

3.6 Risk Control

"Safe production" is the basic requirement of modern industrial production, and is one of the important means to avoid unnecessary losses. The introduction and application of Internet of Things can help enterprises carry out more comprehensive and efficient security management and control. For example, the Internet of Things sensing technology can predict possible dangers and potential hazards, advance warning, and eliminate security risks[5]. The positioning and monitoring functions of the Internet of Things can have a more accurate prediction of the specific location and development of the accident site, so as to help the staff and rescue workers quickly develop scientific research programs. Through the monitoring of temperature, pressure, humidity and the environment around the equipment, and the comprehensive comparative analysis of the obtained data with the safety accident data and historical production data, the links prone to safety accidents in the production process are controlled and managed, and a more scientific and accurate management mechanism is developed, thus improving the accuracy of risk regulation.

3.7 Energy Conservation and Emission Reduction

China vigorously advocates the green economy and implements the sustainable development strategy, and the combination of Industry 4.0 and Internet of Things can rely on wireless sensor network technology for real-time monitoring and surveillance of resource waste and pollutant emission treatment in the production environment, and can build a comprehensive environmental detection mechanism and tracking system. When the pollutant leakage occurs, the Internet can be used to notify the corresponding regulators in a timely manner to take measures to deal with and rectify, so as to prevent pollution in a wider range, maintain the ecological environment, and promote enterprises to truly achieve the sustainable development. In addition, the introduction and installation of IoT equipment and sensors in key areas of the factory can record, detect and statistics the use of gas, water, electricity, etc., and understand the energy consumption within each area, so as to develop and design more reasonable work plans, reasonably manage and schedule the use of equipment during peak hours, avoid energy waste, and reduce energy consumption costs.

4 Conclusion

In summary, in the context of Industry 4.0, the introduction and application of Internet of Things can be realized through the interconnection of factory equipment, smart factory security system, personalized production, intelligent logistics, digital twin, risk control, and energy conservation and emission reduction. At the same time, we should also actively explore more innovative and effective industrial production models and find more effective ways to meet new challenges.

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