Research on Big Data Acquisition Bus Technology of NC Machine Tool

Jindong Li *
Sichuan Vocational and Technical College Suining, Sichuan, 629000, China
*Corresponding author’s e-mail: tg667788@xzcestudio.com

Abstract—Big data technology has strongly promoted the development of social productive forces, and commercial applications are continuously expanding in all walks of life. It also uses the power of Internet technology to provide strong technical support for the development of the entire industry. In terms of the production of CNC machine tools, due to the use of big data technology, CNC machine tools have been rapidly produced on a large scale, which has played an important role in the upgrading of the entire CNC machine tools and the improvement of quality and efficiency. This article takes the technology of big data acquisition bus for CNC machine tools as the topic, through researching and discussing its concept, meaning and related strategies, in order to effectively improve the production scale and reference.

Chinese Library Classification number : TP23
Document Identification code : A

1. INTRODUCTION
At present, with the continuous development of the country’s economic construction, the people’s living standards have undergone major changes. All aspects of the country’s construction have achieved world-renowned achievements, especially in economic, political, national defense, diplomacy, science and technology, ecology, national defense and other aspects that have made important breakthrough developments. In the process of economic development, the development of science and technology has played an important role in promoting. The development of economy mainly depends on the development of industry. For CNC machine tools, they have played an important role in the development of industry. For the entire big data technology, the extensive application of machine tools can greatly promote the rapid production of the machine tool industry, increase the added value and technical content of the machine tool, and ensure the production of high-tech products of high quality, thereby effectively improving and driving industrialization development in country [1].

2. CONCEPT OF BIG DATA ACQUISITION BUS TECHNOLOGY FOR CNC MACHINE TOOL
The so-called NC machine tool big data acquisition bus technology is to make full use of big data integration technology, Internet technology and advanced storage technology in the process of NC machine tool production to make the whole machine tool production more intelligent, large-scale and scientific. As shown in figure 1, it is the structure diagram of the big data acquisition bus for CNC machine tools. In the process of production, the overall collection of big data is ensured at the same time. Through the integration of the entire data, it can effectively achieve higher precision, better results and faster processing of parts during the working process of the machine tool. As far as the current situation is concerned, the overall level of CNC machine tool production is not high enough, although the understanding of technology-based enterprises is relatively high. However, the lack of funds in the
early stage has caused the entire production of CNC machine tools to exist only in one-sided and fragmented production, without forming an overall advantage and joint force. Therefore, for the R&D industry of the entire machine tool production industry, serious analysis and research are needed, and strong economic investment, technical investment, and R&D investment are used to comprehensively improve the overall quality of CNC machine tools.

**Figure 1 Structural diagram of big data acquisition bus for CNC machine tools**

3. **APPLICATION SIGNIFICANCE OF BIG DATA ACQUISITION BUS TECHNOLOGY FOR CNC MACHINE TOOL**

3.1. **Further Improve the Large-scale Production of CNC Machine Tools**

The comprehensive increase in the application of big data acquisition bus technology for CNC machine tools can further enhance the large-scale production of the data-controlled machine tool industry. Affected by various current factors, although the country has developed the CNC machine tool industry relatively early, it is compared with similar industrial powers such as Japan and Germany. In particular, there is still a big gap in the application of big data collection to the production of CNC machine tools. The country is gradually realizing these problems, and is increasing its horsepower to invest huge funds in research and analysis to produce large-data application-type CNC machine tools with complete intellectual property rights, ensuring large-scale production and improving the overall competition level of machine tools [2]. Big data collection technology plays a very important role in the development of the entire machine tool industry. After the full application of the big data acquisition bus technology, it will have a huge promotion effect on the standardized production and large-scale production of CNC machine tools. Firstly, it solves the problem of centralized modules in the production process. Secondly, it solves the problem of fragmented installation in the production process, and finally solves the problem of low efficiency of workers in the process of factory inspection.

3.2. **Further Improve the Use Efficiency of CNC Machine Tools**

It can comprehensively strengthen the research on the big data acquisition bus technology of CNC machine tools, which can effectively improve the use efficiency of CNC machine tools. Therefore, there must be a security measure for information flow, as shown in figure 2. Everyone is very clear that the current competition between countries is ultimately a competition of scientific and technological strength, a competition of industrial strength, and even more a competition of talents. For the overall development of CNC machine tools, although some Western countries have a large gap in the overall
accuracy of machine tools compared with the country, the overall strength of the country’s machine tool industry is not strong enough, and the overall technological level is still relatively low. But for big data technology, it is still at an advantage. In the next step, the big data collection bus technology will be fully applied to CNC machine tools, which can greatly improve the use efficiency of CNC machine tools, can effectively improve the overall machining accuracy of machine tools, and play a very important role in improving the overall economic benefits of the machine tool industry[3].

3.3. Further Enhance the Cooperation and Development of the Internet Industry and Data Machine Tools
Comprehensively strengthening the application of big data acquisition bus technology for CNC machine tools can also enhance the cooperation and development of the Internet industry's secret CNC machine tools. As one of the most mature technologies, big data technology is widely used in many industrial manufacturing in the country. As far as the entire CNC machine tool industry is concerned, comprehensive research and deepening transformation should be carried out from the ground up, and big data technology should be organically combined with CNC machine tool production technology. This is of great significance for both the CNC machine tool production industry and the Internet industry. The big data collection bus technology is organically combined with the production and processing of CNC machine tools. Through the accurate push and effective analysis of big data, the accuracy and efficiency of the work of CNC machine tools can be further improved, and the overall processing strength can be effectively improved [4]. It can have a certain impact on foreign machine tool industry production and promote the leap-forward development of our country’s machine tool industry.

4. APPLICATION STRATEGY OF BIG DATA ACQUISITION BUS TECHNOLOGY FOR CNC MACHINE TOOL
4.1. Application Strategy of Big Data Acquisition Bus Technology for CNC Machine Tool
Figure 3 shows the bus structure of the CNC machine tool big data system. The bus structure of NC machine tool big data system is for the application method of NC machine tool big data acquisition bus technology. One is to comprehensively strengthen the construction of cloud equipment for CNC machine tools, and integrate all relevant data and information technologies into the overall processing
control system of CNC machine tools. The powerful push function of big data can effectively solve the problem of small storage of CNC machine tools, and can effectively solve the problem of complex editing and processing programs of CNC machine tools. For the construction of the cloud equipment platform, it is necessary to integrate related technical equipment to effectively ensure the overall performance and technical advantages of the entire machine tool. In the process of constructing the cloud equipment platform, it is necessary to combine the specific requirements and functions of the machine tool, and carry out corresponding data fusion to ensure the performance and processing quality of the machine tool during use[5].

Figure 3 Bus structure of big data system of CNC machine tool

For example, in the process of constructing cloud equipment, for the entire CNC machine tool manufacturing enterprise in the process of entering production, the compatibility and practicability of its information equipment should be ensured first. According to the overall performance of the software system and the technical requirements of CNC machine tools, it is fully matched. This first ensures that it can meet the maximum load of the CNC machine tool to the greatest extent during the process of data fusion and testing, and can effectively ensure the service life and maximum output efficiency of the CNC machine tool. Big data cloud equipment mainly includes the following equipment, including storage equipment, control equipment, and transmission equipment [6]. To ensure the superior performance of the equipment, it is necessary to ensure the high storage capacity, high computing capacity and high transmission rate of the equipment. The advantages and effects of the application can be exerted for the entire cloud equipment and the next cloud platform construction. In the process of omni-directional processing of parts and equipment, CNC machine tools need to control the angle, speed and direction of their rotating tools according to the data information stored in the core. The control of the direction is the most important, and it is the core component of the entire CNC machine tool. The control of the direction is more derived from the instructions issued by the control device in the device. Effectively ensuring that there are no problems with the control equipment is the key to ensuring the entire big data acquisition bus technology.

4.2. Strengthen the Construction of CNC Machine Tool Cloud Platform

Another important application of comprehensively strengthening the big data collection and summary technology of CNC machine tools is to comprehensively strengthen the construction of CNC machine tools. As shown in figure 4, it is a CPU-centric single-bus platform. For the entire platform, it plays a very important role. The use of a good platform can quickly find and solve various situations and problems in the operation of CNC machine tools, and can effectively ensure that the machine tools are in a normal working state. The construction of its PTZ mainly includes processing data analysis system, platform operation diagnostic system, data operation inspection system and tool control system. These systems as a whole form the entire cloud platform of the CNC machine tool can effectively support the normal work of the entire CNC machine tool. The input related instructions can be analyzed scientifically and effectively, and each power system can be effectively controlled for system energy
distribution. At the same time, it is ensured that the machine tool can give early and effective early warning in the process of failure, which greatly improves the service life of the machine tool.

![Single bus centered on CPU](image)

**Figure 4 Single bus centered on CPU**

For example, a CNC machine tool production enterprise in the process of system integration, for big data acquisition and summary technology, should focus on the following aspects of the work and effectively ensure the integrity and efficiency of the whole machine tool. In the process of technical operation, technical personnel should first be familiar with the related performance of the cloud platform, so as to facilitate better operation and effective use of CNC machine tools to ensure that they can play a role. In the process of using the data analysis system, the relevant technical performance work instructions and the relevant special requirements should be effectively identified. The cloud computing and cloud service technology platforms exchange and analyze timely data with the cloud platform, and then send the output commands to the pressure sensor, temperature sensor, vibration sensor and displacement sensor respectively. After receiving the data commands from the cloud platform, the corresponding sensors analyze and process the data respectively [7]. Through the pressure sensor to make the transmission device of the CNC machine tool to the parts that need to be processed for reasonable recovery, it can ensure that the parts are firmly combined with the turntable. In the same way, the temperature sensor receives the command to cool the parts processing equipment in time according to the working condition of the machine tool to ensure that the parts do not appear high temperature deformation, which affects the processing. The vibration sensor and the displacement sensor also work according to their own instructions corresponding to the corresponding equipment. The cloud data platform then feeds back relevant data according to the working state of each sensor, so as to ensure that the control system can adjust the working state of the machine according to the data, and finally achieve the purpose of efficient output.

4.3. **Strengthen the Data Optimization of CNC Machine Tools**

Comprehensively strengthening the data optimization work of CNC machine tools also plays a very important role in the big data collection of CNC machine tools. The timely transmission and collection of data is the key to effectively ensuring the efficient operation of CNC machine tools. For the entire data collection work, after the corresponding data collection, some technical data should be optimized in a timely manner. In order to effectively ensure the stability and efficiency of CNC machine tools, it can better reflect the advantages of big data. The optimization of data collected by CNC machine tools includes optimization of drive data, optimization of temperature data, optimization of displacement data, and optimization of transmission data. As shown in figure 5, it is the optimized structure of the field bus interface of a certain CNC machine tool position detection component.
Figure 5 Field bus interface of some position detection element of CNC machine tool

For example, in the process of data acquisition and optimization, the production machine tool enterprise should comprehensively upgrade and improve the core of the CNC machine tool, the control system. It can effectively ensure that the machine tool can combine the big data technology to quickly and accurately carry out the relevant instructions during the normal operation of the machine tool transmission. At the same time, further optimization of related data is needed to improve the output performance of the machine tool. In the process of optimization, it is necessary to optimize the relevant temperature control data, pressure control data, and displacement control data that are not related to the stable output of the actual power of the machine tool to achieve accurate transmission of instructions and ensure the stable and efficient operation of the machine tool.

5. CONCLUSION

In summary, comprehensively strengthening the research on the big data acquisition bus technology of CNC machine tools plays a very important role in effectively improving the development of the entire machine tool industry and ensuring the large-scale production and use of CNC machine tools. Although our country is still in the development stage in terms of big data collection and CNC machine tool applications, the prospects for the development of the entire CNC machine tool industry are very bright. While the country is vigorously developing industrial-scale production, it is believed that in the near future, for the development of the CNC machine tool industry, it will definitely be able to walk in the forefront of the world.

REFERENCES

[1] LIANG Zhuojun. Research on Big Data Acquisition Bus Technology of CNC Machine Tool J. Internal Combustion Engine & Accessories,2017(23):41-43.
[2] Song Jie, Wang Keshe, Dong Qingxia, Du Hui. Manufacturing Technology & Machine Tool,2016(11):49-54.
[3] Chen Hao. Data Acquisition Device of NC Machine Tool High-frequency Sensor Based on HIO-1000 Bus Module [D]. Huazhong University of Science and Technology,2015.
[4] Li He, Deng Zhi-Ming, Golilarz Noorbakhsh Amiri, Guedes Soares C. Reliability analysis of the main drive system of a CNC machine tool including early failures. Reliability Engineering and System Safety, 2021, 215.

[5] Wang Baoqiang, Wei Yuan, Liu Shulin, Gu Dan, Zhao Dongfang. Intelligent chatter detection for CNC machine based on RFE multi-feature selection strategy. Measurement Science and Technology, 2021, 32(9).

[6] Wang Shuchen, Zhai Hongbo, Xu Zhiru. Data acquisition and control of CNC machine tools based on CAN bus. Journal of Jiamusi University (Natural Science Edition), 2005(03): 362-364.

[7] Dai Zhiqiang. Research on tool wear warning system combining edge computing and cloud optimization. Nanjing University of Aeronautics and Astronautics, 2020.