Research on the Application and Development Trend of Automation in Mechanical Manufacturing

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Abstract. With the development of science and technology, automation is increasingly used in industrial production, which has greatly improved production efficiency. Based on this, this article studies the application and development trend of automation in mechanical manufacturing. First of all, automation was summarized, its concept, basic characteristics and development status were introduced, and then the application of automation technology in machinery manufacturing was analyzed, including application principles and practical applications. Next, we explained the development trend of automation in the field of machinery manufacturing, and then several problems in the current development were explained, and finally we put forward corresponding suggestions based on the above analysis. The application of automation technology has great advantages in cost control and improving the core competitiveness of the market. To ensure its long-term development, we must attach importance to the introduction of new technologies and the optimization of production quality.

1. Introduction
The gradual improvement of science and technology level has made traditional mechanical engineering manufacturing technology have restricted the development of enterprises. In order to improve the production level and management level of enterprises, the production process of mechanical engineering is gradually moving towards the direction of automation and advanced [1]. This not only drives the rapid development of the machinery industry, but also brings new impetus to the market competition of the machinery manufacturing industry. However, since China's automation technology started late, its development is still in the exploratory stage, but in order to further develop manufacturing, it is necessary to research and explore its characteristics and development prospects so that enterprises can use mechanical automation manufacturing technology to strengthen production.

2. Automation Overview

2.1. Automation Concepts
Automation mainly refers to the use of machines instead of manual inspection, processing and control measures. To achieve this purpose of automation, a series of settings such as instruction storage settings, instruction control settings, and execution settings need to be installed on the machine. The
purpose is to be able to achieve the purpose of providing production efficiency and saving production costs [2].

2.2. Basic Characteristics of Automation Technology
The first feature of automation technology is extremely high security, and the development of computer simulation technology has established advance simulation of safety demonstration for engineering design.

It is carried out before the implementation of the production plan after drawing with the relevant mechanical production technicians. The traditional method is to let the construction workers work in actual operation, which cannot further ensure the safety of the workers, but now the simulation technology is used to identify and verify the unsafe factors, after using the virtual computer, the risks to the safety of workers and parts during the manufacturing process have been largely avoided. Second, their general scope is relatively wide. At present, China's computer technology and practical interconnection technology are constantly developing, in order to expand automation technology, the application provides a solid foundation, which includes both the mechanical manufacturing process, as well as the research, construction, packaging, and transportation processes [3]. Third, in the past, our machinery production relied heavily on workers, especially the processing accuracy is relatively high, and it must require experienced workers to complete it. Now, special software coding programs using automation technology are used to reduce the requirements of the processing program on the workers' own capabilities, thereby improving the efficiency of machine production and improving production efficiency has laid a solid foundation.

2.3. Development Status of Automation Technology
Automation technology can be traced back to the 1920s at the earliest. During the 1920s and 1950s, it was in the initial stage of mechanical automation. From the 1950s, with the emergence and popularization of computer technology and the development of modern control theory and improvement, automation technology has experienced a stage of development from semi-automation to full automation. The development of China's automation technology started relatively late compared to western countries, and there is still a certain gap compared with western developed countries. There are still technical personnel problems in our automation technology such as low quality, backward management methods, and low R & D levels need to be resolved.

3. Application Of Automation Technology In Machinery Manufacturing
Automation technology is widely used in various industries, and its definition is different in different industries. In the mechanical manufacturing industry, automation technology mainly refers to the automatic operation of mechanical equipment such as microcomputers and machine tools without human operation. With the continuous development of science and technology, the precision of operation has become the highest requirement in the industry, and this precise cycle operation is an important advantage of automation technology. Under the production mode of automation, it not only changes the disadvantages of traditional manual production, but greatly reduces the amount of manual tasks and saves more human resources for machinery design and manufacturing enterprises. At the same time, it can also ensure that the efficiency of machinery operation meets the requirements, which can greatly improve the production efficiency of the enterprise and reduce the labor cost required by the enterprise. Under such advantages, automation technology has covered the field of mechanical design and manufacturing, from mechanical design to manufacturing, from equipment testing to transportation, automation technology has been applied, and it has become a must-apply technology for modern mechanical design enterprises. In the process, we can clearly recognize this. For example, Siemens has always attached great importance to the application and innovation of automation technology in mechanical manufacturing in its development process. In 2017, Siemens' scientific research investment totaled 5.056 billion euros. Among them, 800 million euros were invested in automation technology. In the fiscal year financial report released by Siemens in 2017, revenue
increased by 4% year-on-year to reach 83 billion euros. The profit of physical business increased by 8% year-on-year to 9.5 billion euros [4]. It is the emphasis on the development of related technologies that has made Siemens the world leader in the research and development of electronic and electrical equipment for nearly 200 years.

3.1. Application Principles of Automation Technology In Machinery Manufacturing

3.1.1. Technology innovation and product development
In mechanical design and manufacturing and automation design, technological innovation and product research and development should maintain a common progressive development speed, that is, related industries and industries must attach importance to both the economic benefits brought by product research and development and technology. Innovation brings long-term development advantages to itself, so that in the entire field of mechanical design and manufacturing, to ensure the phased development and long-term development of its own industry and industry. In the process of product development, designers can use information, intelligence and the direction of automation to develop new products, such as integrating information-related technologies into information processing equipment to improve the efficiency and accuracy of information processing.

3.1.2. Meeting the needs of the times
The intelligentization and automation of mechanical products have become the development trend of mechanical design and manufacturing related industries in the current era. Therefore, in the process of automation design and mechanical manufacturing, it is necessary to meet the needs of the industrial industry in the current era. On the basis of improving the performance of mechanical automation, improve the market competitiveness of related industries, and at the same time attach great importance to the innovation of automation and intelligence. It is clear that automation and intelligent innovation are the only way for industry and industry to develop for a long time.

3.2. Practical Application of Automation In Machinery Manufacturing

3.2.1. Flexible application of automation technology
The application of flexible systems in mechanical manufacturing can maximize the combination of market environment and demand changes, and timely adjust the production system, which can make products meet the current market demand, and then in the process of machinery manufacturing, it can organically integrate market demand, product design and product production, and in the process of production, computer technology is used to complete the control of the entire process. This will not only improve the company's processing of information, but also complete the processing of information and data with the minimum investment amount [5]. According to the changes in the market, the company will make strategic adjustments in time to make the company's products richer and improve its adaptability to the market. Flexible machine manufacturing can significantly improve the production efficiency of the enterprise, while also ensuring the superior quality of the product, thereby creating greater benefits for the enterprise.

3.2.2. Intelligent application of automation technology
The intelligentization of mechanical manufacturing refers to the application of intelligent technology to various links in the production process of mechanical products. It relies on computer technology to imitate human thinking maintenance, replacing the work done manually before. Intelligent machine manufacturing can better reflect our human wisdom. Intelligent machine manufacturing can complete the corresponding work by continuously adjusting parameters automatically, and can also adapt mechanical adjustment to changes in the environment. When the external situation is very urgent, its adaptability becomes very strong, so that it can ensure that the entire system can maintain the best state operation in various emergency situations. Compared with traditional mechanical automation
manufacturing, the automatic mechanized system has great advantages in a large area. It can not only complete the learning on its own, improve the performance of the system, but also change the working state according to changes in the environment [6]. At this stage more and more people are starting to pay attention to intelligent devices and gradually introduce artificial intelligence technology. This latest technology makes the intelligent system more comprehensive development, and at the same time more and more technologies are integrated into automated technology, such as CAD and CAPP.

3.2.3. Virtualization application of automation technology
Virtualization technology in mechanical manufacturing technology covers a lot of technical fields, including computer technology, information and communication technology, etc. At the same time, on the basis of relying on computer and modeling technology, you can come up with a relatively completed and diversified framework systems. Virtualization technology mainly simulates the cooperation between humans and materials in the production process and every link in the actual production process. The purpose of doing so is mainly to find out what may happen during the production process. For the problems that have arisen, before starting production, formulate corresponding solutions to facilitate preparation in the production process. This can not only reduce production costs, but also reduce the production cycle and development cycle of the product [7]. Not only can it improve the enterprise competitiveness but also minimize product problems.

3.2.4. Practical application of NC technology in China's production and life
At this stage, China's social economy and industry are in the process of rapid development, and the machinery industry has also made considerable progress.

The demand for mechanized technology is also increasing. Due to the low production efficiency of the past production methods, it can no longer adapt to the current large-scale production, which not only wastes manpower and financial resources, but also cannot guarantee the final quality of the product. The emergence of automation technology is a good way to solve these problems, and digital control technology is a branch of automation technology. In fact, digital technology is the use of software in the production process to realize the automated management and operation of mechanical equipment. The software program can control the mechanical production process very efficiently. Of course, the professional skills of the technicians are also improved a lot. Therefore, the scientific and reasonable software design can further ensure the automation of subsequent mechanical operations, which greatly reduces manpower.

4. The Development Trend Of Automation Technology In The Field Of Mechanical Design And Manufacturing
From the current development status of machinery manufacturing, the future development direction of China's machinery manufacturing technology is as follows:

4.1. Networked Machinery Manufacturing Technology
According to the current development trend of science and technology, most of the production and manufacturing are more or less labeled with "Internet +". This is the development trend of the interconnected era, and it is also a major change in the development of technology into the new era. Manufacturing development must be combined with the Internet. At present, the networked trend of mechanical automation is becoming more and more obvious. The specific performance is now used in applications such as remote task processing, real-time monitoring of production conditions, and equipment fault location. This application also reflects the concept of comprehensive automation. It is undeniable that such technology will have a broader development prospect and the development potential will be even greater. Therefore, mechanical engineering automation technology will involve machinery manufacturing, management technology, and network technology, and these technologies are highly concentrated. It also puts forward new requirements for the training of talents. Technical management talents also need to learn more about computer networks in order to better adapt to future
development trends. The current development of mechanical automation in China still lacks a certain technical foundation. One point is different from the advanced development situation abroad. In the process of China's mechanical automation, to achieve a high degree of comprehensive automation of machinery manufacturing, it is necessary to introduce corresponding automation equipment and technology. In the short term, it seems that enterprises take great risks to invest in production costs, but from the long-term development of enterprises, this approach is the most wise and the most rational, and has great positive significance for improving the overall operating efficiency of the enterprise.

4.2. Supporting Machinery Manufacturing Management Equipment
In the process of the development of machinery manufacturing, equipment and technology have been matched. This mode can maximize the utility of the equipment, maximize the relevant production technology, and realize the efficient use of resources. Therefore, only when professional equipment and professional technology are in phase, only when they are combined can the production level be improved, which will become increasingly apparent in the future development of machinery manufacturing. The development of machinery manufacturing is based on science and technology, including network control, computer modes, and faults, positioning and other advanced functions [9]. Therefore, creating high-level and high-performance machinery management equipment, production equipment, etc., is one of the future development directions of mechanical automation.

4.3. Economical Machinery Manufacturing Technology
Machinery manufacturing should be developed with reference to the production efficiency of enterprises. In order to maximize the use of resource costs and reduce production costs to a certain extent, more and more economical machinery manufacturing technologies will emerge for machinery production. Enterprises bring better production and operation efficiency. In China, although machinery manufacturing technology started late, in the actual exploration and research, China has achieved many delightful results in the field of machinery manufacturing. Because the level of development between countries is different, and many technical levels, including machinery manufacturing technology, are different, and the characteristics of economics have never changed.

4.4. Green Machinery Manufacturing Technology
Combined with the sustainable development concept currently advocated in our country, in order to achieve stable economic development, the protection of the environment in the production process is also an extremely important aspect. In order to achieve the sustainable development of machinery manufacturing, technology should formulate reasonable development goals, find a balance between production and environmental protection, and actively solve the problem of pollution in related technologies. In the process of optimizing machinery manufacturing technology, not only must it consider its production of production enterprises benefits, at the same time, the reasonable use of materials and the recycling of resources must be considered, as well as the maintenance and repair of manufacturing equipment [10].

4.5. Intelligent Machinery Manufacturing Technology
According to the current application of China's science and technology and the development trend of the times, it can be known that the application of automation technology is in the context of China's gradual improvement in science and technology.

Relevant industrial industries must apply science and technology to mechanical design and manufacturing in a reasonable way, so that the industrial industry can not be eliminated by the development of the times and realize the innovation of industrial intelligence. For example, for some common mechanical manufacturing problems, design the corresponding computer program and implement it in the actual production and application process, so as to achieve further improvement in production efficiency and production quality; the industrial industry should also use science and
technology to create corresponding production guidance in actual machinery production system to make the entire industrial machinery manufacturing production process more standardized.

5. Problems In The Application Of Automation Technology

5.1. Backward Automation Level
Due to the late start of China's automation technology research, at present, China's automation technology has only mastered some core technologies. Compared with developed countries with higher levels of automation, there is a certain gap, not only in terms of technological mastery, but also in research and development. In the process, due to the emergence of various problems, it has restricted the development and progress of China's automation technology to a certain extent, and the application level of China's automation technology has been relatively low due to the backwardness of the automation technology level. It is the unfavorable development of manufacturing enterprises that has restricted the further development of China's manufacturing industry to a certain extent.

5.2. The Quality of Automation Technology Personnel Is Low
The low quality of automation technology talents in China is mainly reflected in the technical mastery. Most of the automation technicians in China simply master the automation control technology. Automation is the most basic technology in automation technology. Automation design and application rarely have technical personnel able to meet this level of requirements, which has led to the lack of R & D personnel in China's automation technicians. Besides, due to the disconnect between theoretical education in colleges and actual automation applications, some parts of our country have the phenomenon that automation technicians attach importance to theory and neglect practice is difficult to meet the needs of automation technology. It is precisely because of this characteristic of young automation technicians that there is even a fault phenomenon in our automation technicians.

At present, there is still a problem of insufficient management level in China's automation technology, which is manifested in the following three aspects. The first is the lack of standardized process management for the application of automation technology, which causes certain problems in the process of automation technology application, and the second is the innovation of automation technology. Insufficient management, lack of investment in automation research funds, and lack of incentives for technical personnel to encourage innovation in automation technology are precisely because of the encouragement and investment in automation technology innovation, which makes it difficult for China's automation technology to achieve significant development and progress. Finally, the management system lacks scientificity and systematicness. The management of automation technology is often carried out locally, but the comprehensive management of automation technology has not been established. The various parts have not been mobilized to cooperate with each other to achieve more efficient management of automation technology.

6. Measures To Promote The Development Of Automation Technology

6.1. Improve Technology
If you want to improve the development level of China's manufacturing industry, it is the key to improve the level of automation technology, and automation technology is the result of multi-disciplinary integration. Only by promoting the development and application of related disciplines, can the level of automation technology be steadily improved, and provide technical support for the development of China's manufacturing industry.

6.2. Emphasis on Talent Training
At present, there are certain problems in the cultivation of technical talents in China. Among them, the disconnection of automation technology education in colleges and universities is a key issue. To this end, we should strengthen the education of automation technology in colleges and universities, and
write automation textbooks that combine theory with practice to strengthen the students' practical practice. In this way, strengthen the students' combination of theory and practice, so that students meet the standards of talents in automation technology. To this end, the school should also strengthen the cooperative training with enterprises related to automation technology, and improve students' comprehensive ability in automation technology in order to train our automation technology talents.

In addition, the existing practitioners of automation also need to strengthen training, collect the latest research results of automation technology at home and abroad, and regularly train relevant personnel to improve their innovation awareness. At the same time, it can also allow experienced technical personnel with automation technology. Automation technicians are trained to help newly recruited personnel adapt to the new environment as quickly as possible to better improve their professional quality. At the same time, they can regularly send high-level technical personnel to study abroad and learn advanced foreign automation technology to improve China's automation technology.

6.3. Improve Management Specifications
First of all, it is necessary to establish a standardized application specification of automation technology, and to work and supervise in accordance with the specification, so as to unify and standardize the application of automation technology and reduce the occurrence of errors; secondly, increase investment in automation innovation; On the one hand, it is necessary to increase investment in talents and encourage innovation in talents to better promote innovation management of automation technology in this way. Finally, it is necessary to establish a comprehensive management of automation technology and improve management efficiency through comprehensive management of automation technology.

6.4. Strengthening Practical Applications
The automation technology needs to be applied to the research results after the relevant research and certain results are obtained. Only through practical tests can the usefulness of the research results be determined, and whether the research results still have loopholes, so as to better improve research results, make research results better serve enterprise production practices, and comprehensively improve China's automation technology level.

7. Conclusion
Mechanical manufacturing is an important link to maintain the normalization of China's industrial development and plays a key role in improving China's economy. From the current state of mechanical engineering automation technology in China, it is very difficult to achieve comprehensive automated production in the machinery industry. It is necessary to improve and solve problems from related aspects such as technology, equipment, and talents. Only in the continuous development and exploration of machinery automation technology in China can we gradually reach the level of advanced countries and provide strong support for China's economic development.

References
[1] Li Chaozhao, Song Meina. Application of automation technology in automotive machinery control system [J]. Communications World. 2016 (15): 106-108.
[2] Zhang Qian. Exploration of mechanical automation technology and its application in machinery manufacturing [J]. Building Materials and Decoration. 2018 (52): 196.
[3] Liao Chengping. Discussion on mechanical automation technology and its application in machine manufacturing [J]. South Agricultural Machinery. 2018, 49 (23): 189-190.
[4] Hu Feng. Discussion on mechanical automation technology and its application in machinery manufacturing [J]. Modern Salt Chemical Industry. 2018, 45 (06): 62-63.
[5] Zhang Yiwu. Research on the characteristics and development trend of mechanical manufacturing automation technology [J]. Times Agricultural Machinery. 2017, 44 (8): 87.
[6] Sun Xiaorui. Analysis of the characteristics and development trend of machinery manufacturing
and automation technology [J]. Shandong Industrial Technology. 2018 (2): 52.

[7] Wei Ruixuan. Analysis on the application and development trend of automation technology in contemporary machinery manufacturing industry [J]. China Equipment Engineering. 2017 (23): 198-199.

[8] Feng Shanyi, Xing Yi. Analysis of the characteristics and development prospects of mechanical manufacturing automation technology [J]. Digital World. 2017 (10): 59.

[9] Zhou Shuyu. Discussion on the application of automation technology in mechanical manufacturing [J]. Internal Combustion Engines and Parts. 2019 (15): 212-213.

[10] Liu Huazhou, Yang Chenfei. Research on mechanical automation technology and its application in mechanical manufacturing [J]. Computer Products and Distribution. 2019 (09): 174.