

The Development Trend of Robots

Jiangcheng Zeng

YALI High School, School's location: Changsha, Hunan province, China
Postcode:410000
andrew19848026255@126.com

ABSTRACT

Various types of robots have been designed to make people's lives easier. To meet requirements of the modern society, the precise control of robots is a key competence for academia and industry. So far, a great deal of development has been made to enhance robot performance, introduce new functionalities, and decrease robot costs. This paper mainly sorted out and analyzed the types and applications of existing robots. Especially, examples of robot areas that arise big attention today include space robots, underground robots, medical robots, construction robots, microrobots, and robots used in industry. The developmental history and application of the above robots will be discussed as well as the technical challenges that the robot manufactures have to meet. Also, this paper gave suggestions for the future development of robots.

Keywords: *Artificial intelligence, Robot development, Robot control, Robot applications, Industrial robots.*

1. INTRODUCTION

People's lives are more colorful than ever, and there are more and more repetitive chores to be done. Hence, people need to do these things in simpler and more efficient ways. For robots, all it takes is a few simple pieces of code and plenty of energy to do the tedious work. Therefore, the use of robots will become more and more common. At the same time, the development trend of robots has also shown a state of leap in recent years. This article will introduce the different functions of robots and the future development trend.

2. THE DEVELOPMENT STATUS

With the development of the information age, artificial intelligence has been highly developed. People have been working on robots since the 1960s. There are two different types of robots, mobile robots, and non-mobile robots, but they are both designed to make people's lives easier. This paper will discuss the development trend of robotics and its impact on future generations. The robot revolution is not an autonomous revolution, but a part of the second industrial revolution characterized by digitalization, intelligence, and networking. If the second industrial Revolution replaced manual labor with machines through the automation and

standardization of equipment, the "robot revolution" pushed for machines to replace mental labor. Its impact is not limited to improving industrial production efficiency, but also fundamentally overcoming the conflict between product cost and product diversity in traditional industrial production models, thereby promoting product development from linear to parallel product processes, and improving the performance of industrial products. The functions are greatly enriched, and the product development cycle is shortened.

2.1 Classification of robots

With the expansion of the field of human activities, the application of robots has been rapidly developed from manufacturing to non-manufacturing. Marine development, space exploration, mining, construction, medical care, agriculture and forestry, services, entertainment, and other industries have put forward requirements for automation and robotics. Compared with manufacturing, these industries are mainly characterized by the unstructured and uncertain working environment, thus placing higher demands on robots. They need robots that can walk and have an external perception.

2.1.1 Underwater robot

Underwater robots can replace human beings to work underwater for a long time in highly dangerous environments, polluted environments, and waters with zero visibility. Underwater robots are generally equipped with sonar systems, cameras, lights, and mechanical arms that can provide real-time video and sonar images. The mechanical arm can lift heavy objects. Underwater robots are widely used in petroleum exploitation, maritime law enforcement, scientific research, and military fields. AUSS of the United States, MT-88 of Russia, EPAVLARD of France, Explorer and CR-01A of China have been used in offshore oil exploitation, seabed exploration, salvage operations, pipeline laying and inspection, cable laying and maintenance, dam inspection and other areas, forming two categories of underwater robots with cables and without cables.

2.1.2 Space robots

A space robot is a multi-party coordination system consisting of a pair of precision hands, a pair of automatic capture mechanisms, and a fixed hand, which can be controlled by natural language and task standard voice with limited words. And it can be used in space stations, free vehicles, platforms, and other space facilities to replace people in the aircraft outside the inspection, repair, supply, and other relatively simple operations. Not only that, space robots can also roam independently in space within a range of several kilometers, can capture targets with low impact, and can move on the framework of structures. Space robot is an important research field of the advanced robot, which has attracted great attention from all over the world. At present, the United States, Russia, Canada, and other countries have developed a variety of space robots. The earliest space robots appeared in the 1970s, when the Soviet Union's Lunar 17 probe brought the world's first lunar patrol robot, Lunar Rover 1, to the moon. Later, the Luna 21 probe brought a real lunar car to the moon. The 840KG rover is equipped with a television camera and a variety of environmental science measurement instruments. It worked on the moon for more than four months, covering 37 kilometers and sending back numerous lunar photos and measurements to Earth. Another example is NASA's space robot Sojanor, an autonomous mobile vehicle that weighs 11.5 kilograms and has six wheels. Its successful application on Mars has attracted wide attention around the world. Robot for the nuclear industry. Foreign research mainly focuses on the flexible mechanism, accurate and reliable movement, fast response, lightweight, good stiffness, easy to load and unload, and maintenance of high-performance servo hand and semi-autonomous and autonomous mobile robot. Typical systems have been completed, such as ORML's robotic radioactive storage

tank cleaning system in the United States, the dual-arm operator for reactors Also, the radiation monitoring and fault diagnosis system successfully developed in Canada, and the C7 Dexterous Hand in Germany, etc.

2.1.3 Underground robot

Subterranean robot pathfinding uses subterranean radar, the so-called underground radar detection system is through the antenna to transmit electromagnetic waves to the ground, and then receives the reflected wave after encountering objects, after technical processing and reaction into color display graphics, to determine the location of objects. That is a non-destructive testing method. The device uses electromagnetic waves called ultra-short waves, and the maximum depth it can detect depends on the ability to emit electromagnetic waves and the resistance encountered underground. In general, it is suitable for the detection of rocky strata, ice, and relatively dry strata. Underground robots mainly include mining robots and underground pipeline maintenance robots. The main research contents are mechanical structure, walking system, sensor and positioning system, control system, communication, and remote-control technology. At present, Japan, the United States, Germany, China, and other countries have developed robots for oil, gas, and other underground pipelines and large-scale pipeline maintenance, and various mining robots and automation systems are under development.

2.1.4 Medical robots

The intelligent delivery robot is mainly responsible for delivering medicine, food to the isolation area and recycling clothing and medical waste in the hospital. Through the rational dispatching of the "brain" control center, they can independently open and close the door, independently take the elevator, independently avoid obstacles, independently charge and, other functions, without human operation. An Ultraviolet disinfection lamp is installed in the cabinet, which can keep the box and articles safe at any time. The robot also has remote real-time voice and video communication functions and can communicate directly with the nurses or patients in the isolation ward through the dispatching system. Drug delivery robots can replace nurses to deliver meals, cases, and laboratory tests, etc. Mobile patient robots help nurses move or transport patients who are paralyzed or have limited mobility. Scientific robots include surgical robots and diagnostic and therapeutic robots, which can perform precise surgery or diagnosis. British scientists are developing a nursing robot that could be used to do the heavy lifting. New care robots will help health care workers identify patients and dispense needed medicines accurately. In the future, nursing robots could check a patient's temperature, clean rooms, and even help doctors keep up with patients'

conditions via video transmission. The main research contents of the medical robot include medical surgery planning and simulation, robot-assisted surgery, minimally invasive surgery, on-site surgery, etc. [1]. In the United States, remote telepresence surgery has been studied in battlefield simulation, surgical training, and anatomical teaching. France, Britain, Italy, Germany, and other countries have jointly carried out research on image-guided orthopedic surgery programs, pocket robot programs, electromechanical surgical tools, and other aspects, and achieved some fruitful results. Beijing University of Aeronautics and Astronautics and the Naval General Hospital have jointly developed a brain surgery robot, which has been successfully applied in clinical practice.

2.1.5 Construction robots.

Construction robots from the invention to the present have experienced a history of more than one hundred years, have experienced mechanical transmission and hydraulic transmission to two generations. Now the robotic construction machinery is called the third generation, known as the milestone of the development of construction machinery. The construction robot can be controlled by remote control, automatic control, and semi-automatic control, and can carry out various operations in the natural environment, among which the organic operation is the biggest characteristic. There are many kinds of construction robots. According to their common technology, they can be classified into three kinds: high technology of operation, high technology of energy-saving and self-diagnosis technology of fault. Japan has developed more than 20 construction robots. Such as high-rise building erasing robot, prefabricated installation robot, interior decoration robot, ground polishing robot, glass cleaning robot, have been practical applications. Carnegie Mellon University, Massachusetts Institute of Technology, etc., are in the pipeline digging robot, inner wall installation robot model development, and carry out sensors, mobile technology, and system automation construction methods and another basic research. China, Britain, Germany, France, and other countries are also carrying out research in this area.

2.1.6 Microrobots.

Fixed microrobot. It looks like rocks, trees, and flowers, and is equipped with a variety of tiny sensors that can detect infrared radiation of the human body, ground vibration when walking, and magnetic field changes caused by metal objects moving. The signals are sent to the central command, which can control weapons in the defensive zone to automatically launch attacks. Motorized micro-robots. Equipped with solar panels and computers, they are programmed to maneuver into enemy positions and die with the enemy.

Biological micro-robots. Research is on attaching tiny sensors to animals or insects to form tiny robots that can travel to places where humans cannot go for combat or reconnaissance missions. Research on micro-robots began in the 1980s. With the development of microelectronic technology, it has become a reality to integrate thousands of electronic components into a tiny space. Influenced by it, people began to imagine microsensors, microprocessors, micro-actuators.

2.1.7 Military robots.

The United States, Britain, France, Germany, and other countries have developed the second generation of intelligent military robots. It is characterized using automatic control mode, can complete reconnaissance, combat, and logistics support tasks, can see, smell and touch in the battlefield, can automatically track the terrain and select roads, and automatically search, thus identifying and eliminating enemy targets. For example, the Nagpal autonomous navigation vehicle and SSV semi-autonomous ground combat vehicle of the United States, the DARDS autonomous Fast Motion reconnaissance vehicle of France, and the M4 Explosive ordnance disposal robot of Germany. ORNL is currently developing military robots for a variety of purposes, including the Abrams Tank and Patriot missile batteries[2].

In general, the development of the future world will be more and more intelligent, and the development of robots will gradually be applied to all aspects. The above robots are only mentioned more and some of the current developments, and I hope there will be more shocking results in the future.

2.2 The development of the robot industry

Since the fourth quarter of 2008, the global financial crisis has led to a sharp decline in sales of industrial robots. In 2010, the global industrial robot market gradually recovered from the bottom of 2009. In 2011, there was an industry Summit on the Global Industrial Robot Market, with annual sales of 166,000 units since 1961. Global sales of industrial robots fell slightly in 2012 to 159,000 units. The main reason is that sales of robots in the automotive industry have continued to grow while sales in the electrical and electronics industry have declined. Automation level as an increase in global manufacturing capacity. People estimate that global industrial robot sales reached 250,000 units in 2017, with a CAGR of 9.5% [3].

The global industrial robot ontology market is mainly concentrated in Central Europe and Japan. In Japan, the United States, Germany, and South Korea, these five countries account for 71.24% of the global inventory and 69.92% of sales. By the end of 2012, a total of 2.47 million robots had been sold globally. The

robots have an average lifespan of 12 years and a maximum of 15 years [3]. It is now estimated that there are between 1.2 million and 1.5 million robots in the world. Sub-regional, Asia/Australia grew by 9%. Demand from China is driving growth in Asia, as sales of industrial robots there rose by 30 percent in 2012. In terms of manufacturing and consumption, Japan is the sole net exporter of industrial robots, with the largest unit capacity in the world, accounting for 66% of the world's robot production. Robots are the largest consumer sector in Asia outside Japan, accounting for about 34 percent, mainly in the Chinese market [3].

Machine tool sales for industrial robot sales reflect the use of robots. To some extent, the rising proportion represents the improvement of the popularization level of robots in China. In the United States and Japan, the sales of four machine tools accounted for the sales of machine tools. From the past data and changing trends, people can see the development of the robot industry. The proportion of Japanese and German robot sales to machine tool sales is stable within a certain range (15%-25%), indicating the sales trend of the three robots and machine tools, and the relatively stable development of the robot industry. From 2006 to 2011, the sales of machine tool robots in China, although improved, are still at a low level, accounting for only 5% [3]. Therefore, China's robot industry has great potential for development.

Japan, the United States and Europe are the world leaders in the development of the robot industry, but their strengths are not the same. Japan's industrial robots, the home robots, have a distinct advantage. Europe is a leader in industrial and medical robots. The main advantages are in the field of system integration, medical robots and defense and military robots.

3.APPLICATION AND FUTURE DEVELOPMENT OF ROBOTICS IN DIFFERENT FIELDS

3.1 The application of robots in medical field

In the medical industry, the application of industrial robots is more and more prevalent. People can do some corresponding auxiliary work for medical services through robots. Industrial robots can only do simple things like point at one point and move things to another, but robot-driven medicine can do so much more for humans when people use robots in many different areas of the medical industry. There is a shortage of talent in this field right now, and not many people want to work in this field, so people must realize automation to enhance the quality of care in this field and reduce the cost of care.

Medical robots can be applied to intelligent hospitals, rehabilitation centers, home care and other

fields, bringing convenience to people's lives. In the future, robots will become increasingly cost-effective, customized, personalized treatment, and supplying better, more precise diagnosis, so people need to support medical innovation.

3.2 The application of robots in agriculture field

In the field of agriculture, the application of industrial robots is also very eye-catching. Europe has long been a leader in breeding and milking robots. On some farms, a milking robot incorporating 3D detection technology can extract more milk from cows during milking. Robotic systems developed by scientists in a project called precision agriculture are also widely used. For example, it could be used to spray pesticides or sow seeds while crops are growing. When harvesting crops, the manipulator can be used to harvest crops, considerably improving the work efficiency. The problem with the agri-food sector is that most farmers are now over 45 years old. It's an aging problem and most of them don't want to do the jobs of farmers, so there needs to be more automation.

In the agri-food industry, people need precision agriculture, automatic sorting and packaging, and automated management of poultry and livestock. In terms of the maintenance and inspection of infrastructure, people all know that the maintenance of infrastructure is very important in our lives, so people need to find a better way to carry out the maintenance. Similarly, good infrastructure is required in energy, hydropower, industrial processes, and other areas.

3.3The application of robots in manufacturing industry

At present, the international industrial robot technology is more and more widely used in the manufacturing industry, has been promoted from the traditional manufacturing industry to other manufacturing industries, and then to mining, construction, agriculture, disaster relief, and other non-manufacturing industries. However, the automotive industry is still the main application field of industrial robots. It is understood that 60% of industrial robots in the United States are used in car manufacturing; global industrial robots used in the automotive industry have reached 37% of total consumption, and those used in auto parts account for about 24% [4].

3.4 The application of robots in public service

With the rapid development of information technology and the rapid popularization of the Internet, artificial intelligence has ushered in the third rapid development marked by the deep learning model

proposed in 2006. Meanwhile, relying on artificial intelligence technology, the application scenarios and service modes of intelligent public service robots continue to expand, driving the rapid growth of the market scale of service robots. Cognitive intelligent support service robot to achieve innovative breakthroughs. Artificial intelligence technology is important in the development of service robots substantive next stage engine, from intelligence to accelerating cognitive perception intelligent direction development, and has carried on thorough research, including interference identification, auditory perception, visual semantic understanding and cognitive reasoning, natural language understanding, emotion recognition and chat, etc., and has made obvious progress. Leading technology companies focus on driverless cars. With the rise of deep learning algorithms, artificial intelligence technology has made great progress and has been widely used in fields such as driverless cars. Leading global technology enterprises represented by Google and Intel have launched a layout. Companies have accelerated the design and development of humanoid robots. At present, robots are rapidly infiltrating into people's daily life, and more and more service robots are applied in family, education, nursing, medical and other industries. At the same time, with the continuous innovation of technology, the ability of robots to imitate human behavior has been gradually improved, and the design of humanoid robots has been further promoted[5].

3.5 The prospect of the robots

In the future, the standardization of robots is also an important direction for the development and application of industrial robots. There is still a long way to go to achieve the standardization of industrial robots, which has been an important goal of manufacturing development. It is hard for different robots produced by different manufacturers to realize the universal exchange of information and parts, leading to the failure of the standardized production of robots. This requires addressing not only technical issues, but also issues of mutual recognition and interests between companies. This is a difficult task, but it must be standardized step by step.

As the information scale further increases, the data scale also further increases. In the future, big data will become the most basic problem for the development of industrial robots. In the face of massive data processing, only one industrial robot may not be able to complete relevant tasks, which require multiple industrial robots to interact to meet the actual production needs. In recent years, intelligent robot coordination technology has made great development. Through the application of intelligent robot coordination technology, people can realize the cooperation between different robots, but

there is still a certain gap with the real interaction work. People must carry out the next step of exploration. In the 21st century, robot technology will continue to be the hot spot of science and technology development. The further development of robot technology will have a more profound impact on the development of social economy and productivity. In the next 100 years, advances in the science and technology will take robots to a higher level. Robots will become partners of human beings and participate in human production activities and social life more widely [6].

4.CONCLUSION

The development direction of industrial robots in the future is intelligent. That is to say, the future direction of robots' research is mainly to make them more intelligent, so that it can better help human beings. Moreover, people also need to broaden the functions of robots, so that more fields can use robots to improve efficiency and reduce economic costs. This article is limited to literature that can be found and suitable for the content of the article. It hopes to provide more comprehensive and careful analysis and conjecture in the future.

REFERENCES

- [1] Zheng L, Liu S, Wang S. Current situation, and future of Chinese industrial robot development[J]. *International Journal of Mechanical Engineering and Robotics Research*, 2016, 5(4): 295-300.
- [2] Li Yibin , 2004, Modern technological revolution and the development of robots, *Journal of Shandong JiaoTong University*, 55
- [3] Yao Yinguo, 2021, Research and suggestions on the development of China's industrial robot industry. *Robot industry*.
- [4] Rainer Bischoff, 2018, presentation in China Academic Journal Electronic Publishing House, www.cnki.net , 47-49
- [5] Zhang Guoqing, 06/2018, About the current application and future development of industrial robot technology, *China Academic Journal Electronic Publishing House*.Page 11
- [6] Zhangqing ,11/2015, The Development and future of industrial Robots, *China Academic Journal Electronic Publishing House*. Page 167