**RSE assignment No.1**

The International Robot Federation's definition of a service robot: a semi-autonomous or fully autonomous robot that can complete services that are beneficial to human health, but does not include equipment engaged in production. Service robot is an emerging field, which is subdivided from the previous robot research. It has a huge market capacity and has broad development and application prospects. The technical content of service robots is relatively high, including visual recognition, collaborative work, navigation obstacle avoidance, flexible grabbing, and so on. At present, each technology point is immature and has great research value.

The products of service robots can be divided from their technical perspectives. Some are mature in technology, while some are still in research. The technology is mature, that is, the product has been launched to the market, the reliability is high, and it has gained better market recognition. Research and development type, that is, product hardware and other products that have been produced, but do not have the conditions to market, are still in the technical research stage. These products are often researched and purchased by universities and research institutes.

**Technology is relatively mature goods**

At present, there are many types of robot products on the market, which are uneven, and there is no uniform standard for classification. The more common and typical products are:

(1) Glass cleaning robot

This type of service robot technology has been quite mature, and the penetration rate is relatively high. The more influential manufacturers are domestic Cobos and German Ponyo.

(2) Cleaning robot

Like the glass-wiping robot, the product is relatively mature and the market popularity is relatively high. Several more famous brand manufacturers:  TOMEFON cleaning robot (Germany), iRobot cleaning robot(United States), Proscenic cleaning robot (Taiwan),Cobos sweeping robot (China). However, new MI cleaning robot, because it has a relatively high cost performance and the majority of fans groups, its future development potential is huge. In addition, MI's strategy is smart home, and it will definitely work on service robots in the future.

(3) Meal delivery robot

Food delivery robots have quietly entered the lives of ordinary people, and it has become the most grounded service robot product in the robot industry. The emergence of food delivery robots is on the one hand to cope with the current situation of difficult employment in the catering industry, and on the other hand, to bring this emerging catering method to the market. It generally has practical functions such as automatic meal delivery, empty plate recovery, dish introduction, and automatic charging. It integrates technologies such as mobile robots, multi-sensor information fusion and navigation, and multi-modal human-machine exchange. It can replace or partially replace restaurant waiters for customers. Service can reduce the number of service personnel and enhance the restaurant's brand image. It has high economic value, so future research directions of food delivery robots will be more integrated with the restaurant.

However, the current problem is that the restaurant service robot can only serve dishes to the table. The robot can only follow the pre-set path. This is why many businesses are discouraged.

(4) “Welcome” robot

The core technology of the welcome robot lies in speech recognition and intelligent movement, humanoid shape, height, shape, expression, etc. all strive to be realistic and humane. Mainly used in hotels, bank lobby, amusement parks, etc. But for the time being, it only plays a personal computer interaction, it is fresh and fun, and don't expect to get the information you want from it.

(5) Rehabilitation exoskeleton assisted robot

Rehabilitation exoskeleton assisted robots developed by various research institutions at home and abroad. The domestic research institutions in this area mainly include the University of Electronic Science and Technology of China and the Chinese Academy of Sciences. Bone-assisted robots are market-oriented.

Among them, Rewalk did a good job. This product has passed the US Food and Drug Administration certification in 2014, and the product has been developed to the sixth generation. But in general, rehabilitation exoskeleton assisted robots are still far from being popular, on the one hand because of the high price, on the other hand, the key technologies are not perfect, and the user experience is poor.

As mentioned above, the types of service robots are very broad and can be broadly divided into service robots in the professional field and personal / home service robots. The above introduces some common and typical service robots. In addition, there are service robots commonly used in the medical field, such as nurse assistants, brain surgery robots, oral repair robots, vascular robots, smart wheelchairs, etc. In other areas, such as Entertainment robots, sports robots, toy robots, guide robots, etc.

**Research and development type**

(1) Humanoid robot arm

Humanoid mechanical arm design of the original intention was to mimic the human arm features (mainly DOF), with a view to achieve flexible human arm movements. Currently popular robot arms are: UR, JACO.

(2) Human-like dexterous hands

The human-like dexterous hand is the end effector of the robotic arm and is the key to achieving stable and dexterous grasping of objects. At present, the better ones in this regard are: HIT / DLR of Harbin Institute of Technology, Shadow (Shadow Robot Company) in the United Kingdom, and Barrett in the United States.

(3) Robot mobile platform

At present, service-oriented robot mobile platforms include: Pioneer, RB-1, Husky, Freight, etc. The hardware technology of this type of robot is relatively mature, and the current research directions focus on path planning and autonomous navigation.

(4) Composite intelligent service robot

A composite service robot, consisting of an intelligent mobile robot, a single / dual lightweight flexible robotic arm, a smart hand, and vision and torque sensors. With the ability of intelligent perception and recognition, autonomous movement, etc., it can assist the elderly to do housework and provide diverse nursing services.

But to be fair, the function of this kind of compound robot is still in the stage of exploration, perfection and enhancement. There is still a long way to go before actually entering the family and serving the people, coupled with the high price, it is even prohibitive for the general population.

Therefore, this compound robot is very popular among universities and research institutes. Based on this type of robot, various technical studies can be performed, such as dual-arm cooperation, autonomous navigation, route planning, target recognition, and stable and flexible grasping. And the coordination and integration of these technologies. Only through the unremitting efforts of major universities and research institutes, and gradually solving various key technologies, can this composite service robot enter millions of households in the near future.

**ideal service robots**

The above section analyzes the existing types of service robots, now I will talk about something about the characteristics of ideal service robots:

1) The self-service system will be relatively complete. The robot has an IQ and a high EQ, so it has the ability to communicate with people. Home service robots and robots working in entertainment venues can sense people's moods and automatically meet their needs.

2) With the increase in the number of intelligent robots, service robots can communicate with each other and coordinate with each other to form the Internet of Things and make everything more convenient.

3) Although the current lidar can scan objects and identify features, it has limitations. In the future, the technical problems of this vision system will be overcome.

4) Robots will have certain innovation ability and flexible problem solving ability to provide people with the greatest help.

As mentioned at the beginning, robot technology is far from the function that people can expect from the bottom of their hearts, and service robots have a long way to go to meet their basic needs. However, with the continuous development of service robot technology and the continuous decline in development costs, we believe that service robots will one day enter millions of households and become a good helper in people's life, work and study. I believe this day will soon come.