

# Status and prospects of elderly service robots

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**Abstract.** Along with the increase of life expectancy and the decrease of fertility rate, the phenomenon of population aging is becoming more and more serious, but at the same time, the shortage of elderly care service personnel is getting bigger and bigger, and the existing model of elderly care has been very difficult to adapt to the needs of the elderly, and the use of elderly care robots has gradually come into the view of the people and has become a hot topic in the development of the research and industry. In response to this requirement, a brief description of the service robot and its related technology has been studied. This paper analyses the elderly service robots and the elderly service robot industry, and concludes that there is enough imagination and creative space for the development of robots and the robot industry. In the face of the fact that the market for elderly service robots is optimistic, this paper argues that there is a need to occupy the research, development and manufacturing market, and sale of elderly service robots as soon as possible as a strategic industrial high ground, so that robots can establish an emotional connection with elderly users and usher in a bright future.

## 1 Foreword

In 2023, China have an elderly population of more than 267 million. It is expected that the elderly population will exceed 400 million by 2033, and the problem of elderly care will become increasingly serious. According to China Health Net, by 2040, the demand for long-term care services for the elderly in China's urban areas will be close to 6.6 trillion yuan. It is difficult to find home nannies and employees of care organisations because of the heavy workload and low pay. This is also the case in many developed countries, with 29.1 per cent of the elderly aged 65 or older in Japan and 20.56 per cent in the United States by 2022. The development of elderly service robots to replace manual care for the elderly can effectively reduce the burden of the family and society to the elderly, reduce the severe shortage of elderly caregivers, the market potential is huge. The current application of personal and family service robots to household robots and entertainment and leisure robots, while the real sense of the elderly service robot is still in its infancy, and are a single robot as the object of research, the function of a single. A single robot is not only difficult to meet the needs of the elderly family in terms of functionality, but also in terms of price, reliability and other aspects of the widespread popularity of the impediment. Therefore, it is necessary to analyse the current situation of elderly service robots in order to find better solutions.

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## 2 Main applications of existing robots for elderly services

Elderly people need many services, so jobs for the elderly may vary. Examples include home services, family relations, rehabilitation, nursing and recreation. Due to the complexity of the technology and limitations in research and development, there are relatively few types of jobs for older people in practice. In 2002, Roomba's vacuum robot avoids obstacles, designs paths automatically, and moves to the load position automatically when energy is low. In 2010, BOT Jilin, a robot with navigation and interaction functions, and in 2013, NEC Japan released a home assistant Pepper. The robot is about 24 inches tall and weighs about 1.3 kilograms and has sensors, microphones, and sensors to detect the human body in the eye. NEC uses cloud computing technology to obtain remote advice on health and shopping services and to monitor older people's protection and disruption issues. In 2014, Aldebaran's ASIMO and France's SoftBank Robotics announced the joint development of the first nationwide robot for voluntary social work. It is the world's first unique robot that can read emotions, facial expressions, voice, intuition, feel emotions, judge emotions, communicate and provide feedback to people. A growing number of new services are now being developed for older people. [1]

## 3 Prospects of elderly service robots

According to our survey and the current development of China's robotics industry, the development of the elderly service robot industry should follow the principle of first easy and then difficult, step by step, as soon as possible to launch the "self-help" and "other help" service tools for the elderly, to guide and cultivate the market. At the same time, research and development of "single-function", "multi-function" and "full-featured" elderly service robots; breakthroughs in core technology, to overcome the key parts and components of the problem. According to the degree of market acceptance, gradually launch "single-function", "multi-function" and "full-function" elderly service robots. [2] In order to achieve this development idea, it is necessary to build as soon as possible, including research and development, manufacturing and sales of elderly service robot industry system.

### 3.1 Improve the level of research and development of elderly service robot technology

The independent innovation ability of research and development personnel, the technical level of research and development institutions and organisations, the degree of marketability of scientific and technological research and development resources, and the degree of breakthroughs in the core technology of senior care service robots are important criteria for measuring the overall level of technology research and development of senior care service robots. [3] Now, China's senior care service robotics technology in R & D still exists in R & D there is a lack of talent reserves, scattered scientific research resources, R & D organisations are not strong, core technology dependence and other issues.

In view of the shortage of core technology research and development of elderly service robots, the basic ideas of China's elderly service robot technology research and development are as follows: (1) Establish the talent gathering, cultivation and service system of elderly service robots. Accelerate the introduction of domestic and foreign high-end talents, give qualified high-end talents relevant treatment in accordance with the laws of the market, and support universities and research institutes to accelerate the cultivation of robotics industry-related professionals. (2) Organise R&D units to establish an industrial R&D alliance, use market means to optimise the allocation of scientific and technological R&D resources, and form an innovative and proactive, scale-leading and well-supported technology R&D system

for elderly service robots. (3) Focus on scientific and technological research and development, breakthroughs in the core technology of elderly service robots. It has established a demonstration application project for senior care service robots, and independently developed core technologies of senior care service robots, such as intelligent cognition, new materials, and interpersonal interaction.

### **3.2 Constructing a perfect sales and service network system for senior care service robots**

The four links of sales mode, sales channels, sales targets and after-sales service of senior care service robots together constitute the sales and service network system of senior care service robots. The best way to solve the problems of obsolete business model, single market channel and insufficient after-sales service guarantee to promote the development of elderly service robots is to improve the sales and service network system.

Specific paths are: (1) Expand the sales market. Actively expand the scope of application of family pension service robots, take the pension institutions as the leading consumption of family pension service robots, and form a reasonably priced family pension service robot market; (2) develop a diversified marketing model for pension service robots, and develop the pension service robot leasing model while developing a single marketing model, (3) expand the sales channels, and take full advantage of the big data, Internet +, information service and other ways to build an innovative business model and develop new sales channels; (4) improve the marketing service network of senior care robots and provide good service.

### **3.3 Instinctual layer design for multidimensional sensory triggering**

The instinctive layer is designed to enable older users to trigger their sensory emotions quickly and directly. The instinctive layer consists of visual, auditory, tactile and other senses. Visual design is composed of style, colour, interface and other elements. The auditory design is based on the speech of the elderly service robot when it is in conversation with the elderly user, and the haptic design is based on the differences in the selected materials. [4] After the sensory decline, the sensory sensitivity and recognition accuracy are at a lower level, and there is a certain ambiguity in the expression of emotions. Therefore, when designing at this level, the relevant theories of perceptual engineering can be used to extract the perceptual elements, so that the sensory needs of elderly users can be made specific, and combined with the intuitive perceptual preferences of elderly users and the objective experimental data obtained from the actual research to guide the design of the instinctive layer of the elderly accompanying robot [5].

### **3.4 Design for generating effective interactions**

This design is used to develop the functionality and interaction patterns of robots that serve older adults. Designers should investigate and articulate the basic functions required by older people, focusing on the individual needs of different types of older people. To ensure smooth interaction with the robot, the designer should anticipate difficulties that may arise in interacting with the robot and use intelligent interaction techniques to overcome them. Empathy skills can be used when designing service robots for the elderly, but most designers do not have experience with the elderly and often have difficulty in directly perceiving the needs of elderly users and understanding their behaviour. [6]. To apply empathy to the behavioural design of elderly service robots, designers must first enter the lives of elderly users and simulate their behaviours in certain life tasks in order to gain insights and identify

problems. Finally, objective analyses and designs are made based on the identified problems [7].

### 3.5 Interaction design for building emotional connections

Emotional connections are formed subconsciously and conveyed to the user in order to build a positive emotional relationship with the elderly user. In order to better utilise robots in elderly care, we need to focus on the first issue: building trust between the older person and the 'technical assistant'. Older users are often resistant to complex and unfamiliar information, and this can be addressed by increasing their familiarity, allowing them to empathise with different objects and features, and to contribute and express themselves more positively in familiar environments. When designers apply affinity design theory to the design of service robots for older adults, they should incorporate affinity design elements into multiple dimensions of the product, such as appearance, functionality, and interaction. [8] Functionality should be kept to a minimum and should not be so extensive as to deprive older people of choice. In terms of interaction, the interaction process should be simplified as much as possible to mimic the naturalness of real-life interactions and to make it easier for the product to gain the trust of older users and to alleviate the sense of indifference and distance brought about by technology.

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