Original Research Article

Design and Application of Intelligent House Robot

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Abstract: As a family-oriented hexapod bionic intelligent house robot, it takes life safety monitoring, intelligent house control, air quality detection, family security, automatic inspection and obstacle avoidance as its main functions. Combined with core technologies including Face and Radio Frequency Identification, Electromagnetic Resonance and Induction, LAM, Intelligent Navigation and Cloud Robot, the robot is established a unique triangular gait in the form of hexapod, which can maintain the function and action stability in various environments, thus become a family housekeeper with multiful functions and practical intelligence.

Keywords: Smart house; Robot; Intelligence

1. Introduction

Smart house has gradually penetrated people's life in recent years while finding their way to be standared and practical. It has experienced three stages: electronic household appliances; residential automation; intelligent housing From their changes in the market, we can see robot's development potential in the service industry. At present, service robots set a precedent for being successfully adopted in medical treatment, family and so on. Among which, intelligent robots have certain basic functions, but the discomfort experience and little interactive emotion triggered by the complex operation mode still exist in this market. Therefore, as for the above problems, innovative design of function, structure, appearance on the smart house robot could provide users with a comfortable home environment and experience.

2. Research background of smart house robot

At present, the continuous development of AI technology increases people's demand for smart house, which promotes the speedy expansion of China's smart house industry. Smart house is of great significance in facilitating people's life and endorsing the quality and efficiency of house life. Consistent with the current application status of smart house robot, there are numerous research results. For example, the British care-O-robot aims to take care of the elderly who live inconvenience. It can do simple household chores and can also be programmed as a close friend. As for the wheelchair-bound elderly move with difficulty, it will give a hand when they are in trouble. Micro expressions could be stored in the robot while being displayed on the LCD screen. Japan's pepper, 4 feet tall, is an intelligent robot developed by Softbank Group. Equipped with a spiral base so that its arms can move flexibly when interacting with people. It is described as an emotional robot as it can interpret human emotions by judging human facial expressions and intonation. The intelligent old raising robot of Family Nanny in China is similar to the family nanny. It can speak, send text messages and make warnings to the background system in case of emergency. The robot can move automatically and remind itself of avoiding furniture and other obstacles[1]. The advantages and disadvantages of three robots are shown in **Table 1**.

Table 1. Comparison of advantages and disadvantages of robots

Items	Advantages	Disadvantages
care-O-robot	Strong technical ability and R&D capabilities.	Complex that the elderly can't use it sometimes, the low popularity
pepper	Strong technical ability and capital strength;	Insufficient marketing channel for product promotion

Family Nanny	Complete functions, professional company and the robot product is the flagship	Weak technical and financial strength, and the less function of the elderly's physical examination

3. Specific design of smart home robot

3.1 Overall design

The overall structure of the intelligent house robot is shown in **Figure 1**, which is mainly composed of Hexapod structure, camera, pan tilt, pan tilt connecting plate, power supply, controller and steering gear slot. The leg structure is designed along with the leg structure of insects in Hexapoda Class, adding the adoption of bionic design principle and imitation the appearance of spiders in form of Hexapod. In combination with the angle control of the leg steering gear slot, the step algorithm is constructed.


Figure 1. The overall structure.

3.2 Gait design

The intelligent house robot is adopted the triangle walking gait of Hexapod insects, which is known as supersede triangle walking gait as the most quick and effective triangle gait of insects. Most hexapod robots are applied to this gait from a bionic point of view. The movement mode of insect triangle gait is simple and fast, which is very suitable for walking robot in straight line.

The gait of old raising intelligent robot in a straight line is shown in **Figure 2**, which is also the walking gait of Hexapod insects. When walking, the six feet are divided into two groups, one is the front and hind foot of one side and the middle foot on the other side, thus forming a tripod to support the body. At the same time, there are only three feet of a group supporting. First, the front foot uses the claw to fix the object and then pulls the robot forward. The middle foot is used to support and lift the body on one side. The hind foot pushes the body forward while turning the body. When walking, the body moves forward and slightly turns outward. Three feet move at the same time and alternate with another group of three feet. By repeating the gait a-b-c-d-e-f-a repeatedly, the robot can move forward continuously.
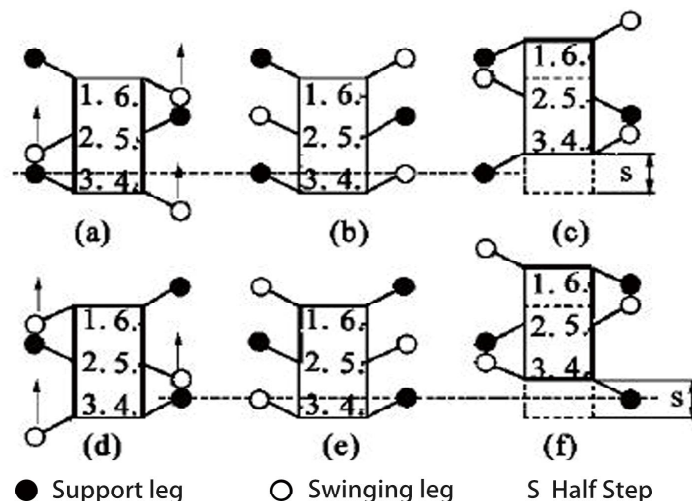
Figure 2. Robot gait figure.

3.3 Function design

The smart house robot mainly is equipped with the function of life safety monitoring, intelligent house control, air quality detection, home security and wireless charging. In the aspect of intelligent perception, the robot can accurately identify the temperature, humidity and air composition of the environment, and promote the automatic control and adjustment consistent with the corresponding sensing system, which makes the intelligent construction of house environment possible. The development of intelligent sensor technology could further improve the level of automation and bring more predictable development and

imagination space in IoT field.

4. Application and development of smart house robot

As a crucial growth field in Made in China 2025, the social robot industry in China has gained a rapid evolation. Various policies offer boundless support for the development of robot products in China while creating an excellent development environment for this industry[2]. Consequently, combined with the current and future social environment is necessary for robot products. It is specially mentioned in the Government Work Report in 2019 that it is necessary to vigorously develop the elderly care service industry, especially the community elderly care service industry. Organizations provide day care, rehabilitation care, meal assistance and transportation services in the community shall be given tax relief, financial support, preferential prices of water, electricity, gas and heat, and new residential areas shall be equipped with community nursing facilities. reforming and improving the policy of combining with medical care and nursing, and expanding the pilot of long-term nursing insurance system, which can prove that China attaches great importance to the old raising industry.

From the current trend of aging population in China, China's population is aging at unprecedented levels, and the number of people has increased sharply, which will inevitably need response measures including the original "institutional old raising". Nowadays, there are a large number of "Home Caring of the Aged" forms, which need the provision of the government, institutions and financial forces as well as the social care, which makes Aged-care model gradually more compound, thus creating opportunities for the emergence of pension products.

Therefore, the intelligent house robot in this paper is suitable for families or institutions with various Aged-care methods such as "Aged-care at Home" and "Aged-care in Institution", in combination with the concept of green health and intelligent Aged-care, which can not only meet the basic needs of health monitoring of the elderly, that is, to detect and analyze the physical data and behavior patterns of the elderly, but also meet the basic requirements of children about safety monitoring for the elderly. the product-people-environment three effective. The key parts of pension services are shown in **Figure 3**.
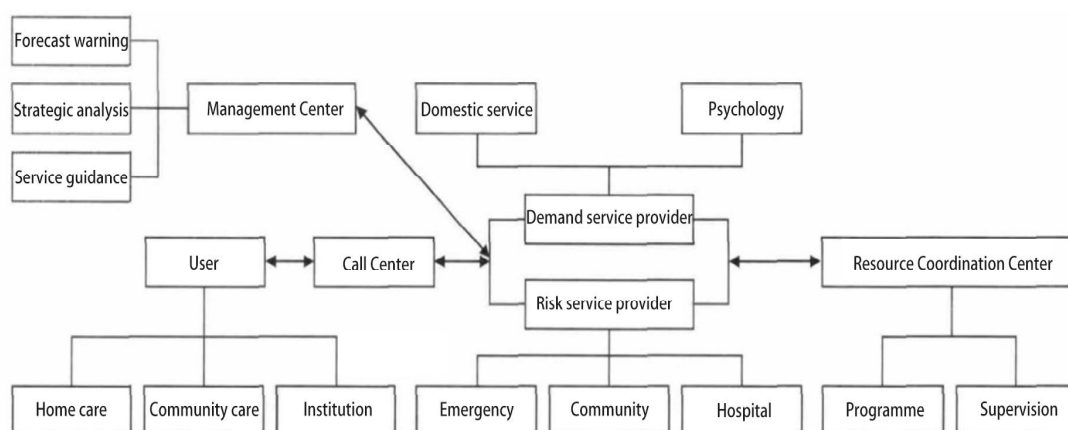
Figure 3. Key parts of Aged-care services.

Furthermore, based on the spiritual care for the elderly, the intelligent house robot should complete more exploration in the interactive experience, not only from the auditory interaction, but also gradually open the interactive experience of olfactory, visual, tactile and other senses[3] with the aim of being more like the care of "people". Expanding the usage scenarios and exploring new functional needs is not limited to general care, but can be extended to functions rehabilitation, intelligent accompany, psychological adjustment with the intention of urging elderly to feel their own sense of value and enrich their life.

5. Conclusion

People's continuously increasing demand for smart house and the incessant update of robot technology will witness the gradually perfect of technology and function of robot in the future, so as to better serve the house market and human life while sponsoring the overall social production and people's standard. Robot will become an indispensable intelligent partner in households. With practical and rich functions and stable operation, the easy-to-use Hexapod bionic intelligent house robot can meet the needs of families. To a certain extent, it can improve the service quality of social intelligence and promote the industrial development of house service robot with the market promotion and prospective.
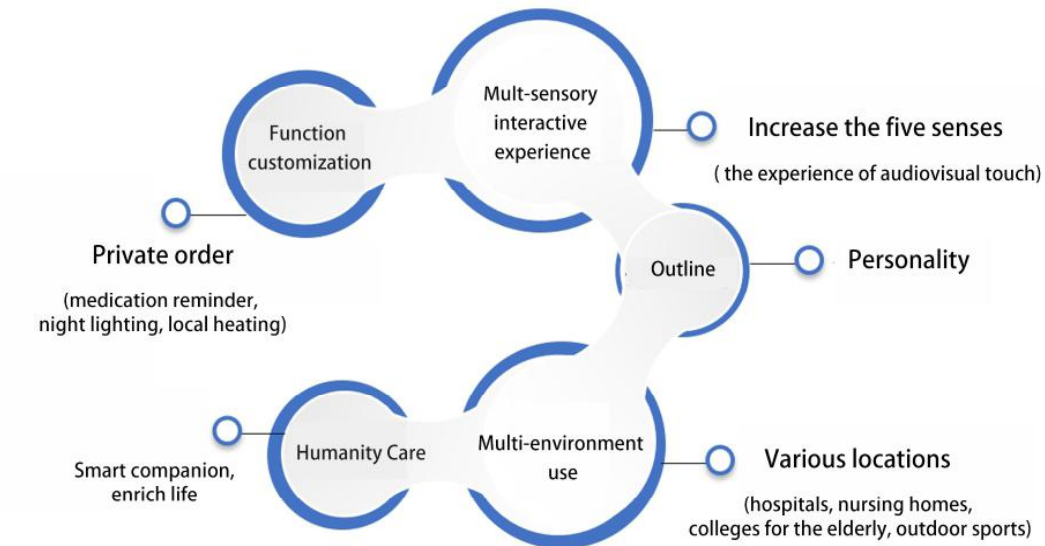
Figure 4. Application direction of Aged-care services.

Acknowledgements

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