REVIEW OF HOTEL SERVICE ROBOTS CONTINUOUS USE

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Abstract

With the development of artificial intelligence technology, hotel service robots have been applied to hotel services. Research status of hotel service robot, Factors affecting the continuance intention of service. The literature review of robots has certain theoretical guiding significance for the research on the sustainable use of hotel service robots.

Keywords: service robots； hotel service robots; continuouse use

Introduction

With the rapid development and transformation of artificial intelligence technology, artificial intelligence and robotics technology have begun to enter human social life. Following the agricultural revolution and the industrial revolution, we have ushered in the third wave of revolution, the artificial intelligence revolution (Tussyadiah, 2020). Changes in artificial intelligence technology have promoted the development of service robots.

Concept of service robots

According to the International Federation of Robotics (IFR), a robot is defined as "a programmable device that can be reprogrammed and multifunctional to perform physical tasks, including motion and perception systems. Capable of operating in both structured and unstructured environments "(ISO 8373:2012).

By design, a robot is a "multifunctional device that can be updated and programmed" to perform various activities by algorithmically moving materials, parts, tools or specialized equipment (ISO 8373:2012). Based on data received from A variety of sensors and other sources, the robot learns and generates new knowledge from known events, ADAPTS rapidly to the environment and makes autonomous decisions in accordance with the "feel - think - act" paradigm, and then performs a series of complex tasks (Bicchi A, 2000). The development of natural language processing and computer vision technology has also made it possible for robots to have convenient and life-like interactions with humans. Based on the different use environments of intelligent robots, researchers usually divide intelligent robots into two categories, namely industrial robots and service robots. Service robots are defined by the International Federation of Robotics organization as "semi-autonomous or fully autonomous robots capable of performing service work for the benefit of humans, but excluding production equipment".

The difference between industrial robots and service robots mainly lies in three dimensions: cognition, manipulation and interaction (Thrun S, 2004). The first dimension, cognition, refers to the ability to coordinate thoughts and actions to achieve goals, enabling service robots to work in an unconstrained environment (Bicchi A, 2000). Service robots can not only perform simple and repetitive tasks, but also more complex tasks, because they can continue to learn during the process of performing the task and the environment. The second dimension, manipulation, refers to the stable performance of completing specific tasks (Thrun S, 2004). Service robots tend to be more flexible than industrial robots and have a wider range of service functions (e.g., security, rehabilitation, and medical care) (Wirtz J, Patterson P G, Kunz W H, et al, 2018). The third dimension, interaction, reflects that the design of service robots is more human-centered (Bartneck C, Forlizzi J, 2004).

Properties of service robots

In the service environment, the design attributes of intelligent robots have a significant impact on the application and effect of robots (Van Doorn J, Mende M, Noble S M, et al,2017). The three design attributes of service robots, namely, the form of presentation, the degree of anthropomorphism and the type of tasks performed, are widely considered to be the key factors determining the way service robots interact with users and the user experience (Bartneck C, Forlizzi J,2004).

In terms of presentation form, service robots can be physical (such as the robot Pepper developed by SoftBank Corporation) or virtual (such as the voice-based robot Siri). Therefore, in this sense, virtual AI software that works automatically and learns over time can also be classified as a service robot (Bartneck C, Forlizzi J,2004).

In terms of degree of anthropomorphism, service robots can be designed to be anthropomorphic and non-anthropomorphic. Specifically, Walters et al. (2008,p.917) proposed three types of service robots according to the degree of anthropomorphism (Wirtz J, Patterson PG, Kunz WH,et al.,2018):(1) mechanical: relatively robotic in appearance, without obvious human characteristics; (2) Humanoid robot: "not human-like in appearance, and easily recognized by human inter actors as a robot, with some humanoid characteristics, which are usually stylized, simplified, or cartoonized human equivalents"; And (3) a robot: which "looks and acts as closely as technically possible to a real human appearance" and is intended to be seen as fully human.

Application of service robots in hotel

The rapid development of science and technology is profoundly changing the way of enterprise operation and customer service. More and more enterprises have built intelligent customer service platforms. At present, service robots have been widely used in various scenarios of the hotel industry and have taken on a variety of work and services instead of humans. Including check-in, check-out, welcome, food delivery, cleaning, butler service, etc. (Guan et al.,2022; Lu et al.,2019; Zhang et al.,2022), see Table 2-1 for details.

Table Service robots in the hotel industry

Application scenario	Character	Feature
Hotel	Front desk staff	Check in, check out, etc
	Room service staff	Deliver food, wake up
	Hotel greeter	Intelligent welcome, consultation and answer
	Cleaning staff	Clean hotel rooms and public areas

Source: Refer to Choi et al

The introduction of hotel service robots has a profound impact on the development of hotels, improves the productivity and efficiency of hotel services, and provides hotels with competitive advantages (Cha, 2020; Khoa et al., 2023). However, the question of whether service robots should be introduced and whether service robots can replace service personnel has been the focus of academic debate, and Ivanov(2019) believes that service robots are more suitable for completing entry-level jobs such as non-technical services. The research of Lu et al. (2019) shows that robots are more suitable to complete tasks with low emotion and low sociability; However, front-line service personnel are more competent than service robots for complex service jobs with high emotional and social aspects. In 2019, half of the service robots at the Henn na Hotel in Japan were fired, both because the robots could not properly solve customer problems and because the cost of replacing the robots was too high. The main reason for the "wave of layoffs" faced by hotel service robots is that service robots cannot completely replace manual waiters at this stage (Yang and Chew, 2020).

Research status of hotel service robot

With the wide application of service robots in the hotel industry, the research on hotel service robots has been widely concerned by scholars. At present, researchers' researches on hotel service robots are mainly prospective, descriptive or speculative (Yang and Chew, 2020; Ivanov, Webster and Garenko (2018) searched and summarized relevant literature and found that current theoretical research can be summarized from the perspectives of enterprise, technology and ethics.

Different research fields have different focus on service robot research. First, from the perspective of enterprises, it focuses on human resource management and service marketing. Human resource management mainly studies whether robot service can replace manual service. Some scholars agree, because compared with traditional human employees, service robots have powerful data processing and analysis capabilities. Therefore, in the process of service delivery, service robots can encourage customers to keep their promises to enterprises through high prediction accuracy. Avoid the reduction of customer loyalty (Huang et al., 2018). In addition, scholars Osawa, Ema and Hattori(2017) further propose that robots are expected to gradually replace humans in mechanical and automated tasks. However, some other scholars hold a negative attitude. They believe that customers' perception of trust may be reduced when

they interact with service robots. Customers will worry about personal data and privacy security and data leakage (Grewal et al., 2020), and service robots will replace some traditional service personnel. The resulting problem of technology dependence and unemployment (Naastepad and Budd, 2019). In the field of service marketing, customers' attitude, experience, evaluation, choice and preference towards service robots are concerned. When Yu(2019) studied the impact of service robots' features on customers' emotional experience, the research results showed that customers were more receptive to service robots with animated features. Mende(2019) et al. found that in the interaction process between customers and service robots, the appearance attributes of service robots have a certain compensatory effect on the lack of emotion and sociability of service robots.

Factors affecting the continuance intention of service robots

Pseudo-humanity has attracted the attention of researchers. Janarthanan et al. (2022) put forward an extended meta-Utaut framework, and conducted research by constructing perceptual intelligence and anthropomorphism (system factors) in the model. The research results show that compared with the traditional meta-Utaut structure, Perceptual intelligence and anthropomorphism are more related to attitudinal construction and persistent intent using chat bot services. By studying the impact of robot features on users' emotional experience, Yu(2019) found that users are more likely to have higher acceptance of robots with animated features. Hsiao et al. (2022) studied the effects of service quality, trust and satisfaction on predicting users' continued use of food ordering chatbots, and found that service quality such as personification is conducive to improving trust and satisfaction, and satisfaction can significantly affect users' continued use intention. Zhang Yi et al. (2022) pointed out that experimental analysis should be used to study the influence of the degree of appearance anthropomorphism of service robots on users' usage intentions, and the experimental results reflected an inverted U-shaped relationship between the two. Y.b.ahnjen (2022) uses social response theory to explore the mechanism of persistent intention of financial technology chat bots, and finds that social cues and emotional arousal play an important role in predicting the persistent intention of financial technology chat bots. Sage et al. (2023), through a systematic review, found that perceived usefulness, performance expectations, attitudes, trust, and effort expectations significantly and positively predicted AI usage intent and behavior. Wirtz et al. (2018) built a service robot acceptance model (sRAM) to explore users' acceptance of service robots and their willingness to use them from three dimensions of functional needs, social emotional needs and relational needs, and found that functional needs have the most significant impact on the acceptance and use of service robots. Go et al. (2020) used the interactive technology acceptance model to study users' acceptance of robots. On the basis of the technology acceptance model, four variables of perceived interactivity, perceived entertainment, self-efficacy and social norms were added, and a total of six variables affected users' acceptance of robots.

Table Conclusion of Service robot related research

Topics	Content	References
Service Robot concept	1. A robot is "a reprogrammable, multifunctional, programmable device that performs physical tasks, including motion and perception systems, and can be operated in both structured and unstructured environments" (ISO 8373:2012) 2. The International Federation of Robotics Organization defines it as "a semi-autonomous or fully autonomous robot capable of performing service work for the benefit of mankind, but excluding production equipment". 3. Liu Xin et al. (2021) define service robot in tourism and hotel industry as a machine body that helps enterprises and customers perform intelligent service tasks. The body communicates and interacts with any member associated with the service through computer programs, artificial intelligence algorithms, sensors and other related technologies. 4. Choi et al. (2021) proposed that service robot is a robot designed based on artificial intelligence technology and used to interact, communicate and deliver services to customers.	(ISO 8373:2012) Liu Xin, Xie Lishan, Li Dongmei. 2021 Choi et al（2021）
Properties of service robot	1. The form of presentation, the degree of anthropomorphism and the type of tasks performed are widely considered to be key factors in determining how a service robot interacts with users and the user experience. 2. In terms of degree of anthropomorphism, service robots can be designed to be anthropomorphic or non-anthropomorphic. According to the degree of anthropomorphism, three kinds of service robots are proposed: mechanical, humanoid and robot. 3. From the perspective of task types, service robots can be robots that complete cognitive analysis tasks based on the basic ability of computers, or robots that complete emotional social tasks based on artificial intelligence technologies such as deep learning.	Bartneck C, Forlizzi J. 2004: Wirtz J,Patterson P G, Kunz W H, et al. 2018 Meidute-Kavaliauskiene I, Çiğdem Ş, Yıldız B, et al. 2021

Application of service robot in hotel	1. Service robots have been widely used in various scenarios of the hotel industry, and have taken the place of humans to undertake a variety of work and services, including check-in, check-out, welcome, food delivery, cleaning, butler services, etc 2. Scholars such as Choi(2023) believe that hotel service robots can also provide simple services, such as maintenance, security, transportation and luggage storage, driving and restaurant service 3. From the perspective of enterprise management, Choi et al. (2021) believe that the introduction of hotel service robots is feasible for ensuring hotel service quality, improving work efficiency, reducing labor costs, facilitating hotel human resource management and innovative service experience, improving enterprise competitiveness and attracting potential customers. 4. Jochen et al. (2018) believe that the stable performance of robots can enable them to maintain a positive and consistent service attitude in the service process for a long time, while hotel staff may affect service quality and efficiency due to negative emotions or work fatigue. 5. At present, service robots are mainly used in hotels to assist employees in completing repetitive labor, consultation and guidance and other basic work (Neuhofer et al.,2013). 6. Ivanov(2019) believes that service robots are more suitable for entry-level jobs such as non-technical services. 7. The research of Lu et al. (2019) shows that robots are more suitable to complete tasks with low emotion and low sociability; 8. The "wave of layoffs" faced by hotel service robots is mainly due to the fact that service robots cannot completely replace manual waiters at this stage (Yang and Chew, 2020).	(Guan etal.,2022; Lu et al.,2019; Zhang etal.,2022) Choi(2023), Choi (2021) Jochen(2018) Neuhofer et al.(2013) Ivanov(2019) Lu et al (2019) (Yang and Chew, 2020)

Research status of hotel service robot	1. From the aspect of human resource management, it mainly studies whether robot service can replace manual service, and some scholars agree (Huang et al., 2018) 2. Customers' perception of trust may be reduced when they interact with service robots, and customers will worry about personal data and privacy security, as well as data leakage (Grewal et al., 2020). 3. Service robots replace some traditional service personnel, resulting in technology dependence and unemployment (Naastepad and Budd, 2019). 4. When Yu(2019) studied the impact of the features of service robots on customers' emotional experience, the research results showed that customers were more receptive to service robots with animated features; 5. Scholar Blut et al. (2021) found that a key obstacle to the adoption of service robots in the hotel industry is the lack of "human-like" characteristics. 6. Scholars Aceta et al. (2021) improved natural language interpreters to enable service robots to complete automatic learning in new interactions to improve and enhance user experience; 7. From an ethical perspective, Zhao Tingyang (2019) believes that when robot technology becomes uncontrolled and irreversible, artificial intelligence will become smarter than human beings, and human civilization will face the end and other problems. 8. Scholar Kortner (2016) pointed out challenges such as dignity, privacy and security when designing service robots for elderly people. 9. Zhou Tiance (2017) points out that service robots have replaced family or social "roles" that were once mainly assumed by women.	Huang et al.2018 Grewal et al.2020 Naastepad and Budd, 2019 Yu(2019) Blut et al. (2021) Aceta et al. (2021) ZhaoTingyang (2019) Körtner(2016) Zhou Tiance (2017)

The influencing factors of service robot's continuous use intention	1. Yu(2019) studied the impact of robot features on users' emotional experience, and found that users are more likely to have higher acceptance of robots with animated features. 2. Hsiao et al. (2022) studied the effects of service quality, trust and satisfaction on predicting users' continued use of food ordering chatbots, and found that service quality such as personification is conducive to improving trust and satisfaction, and satisfaction can significantly affect users' continued use intention. 3. Zhang Yi et al. (2022) pointed out that experimental analysis should be used to study the influence of the appearance anthropomorphism degree of service robots on users' usage intentions, and the experimental results reflected an inverted U-shaped relationship between the two. 4. Sage et al. (2023) found that perceived usefulness, performance expectation, attitude, trust and effort expectation significantly and positively predicted the use intention and behavior of AI through systematic review. 5. Wirtz et al. (2018) built a service robot acceptance model (sRAM) to explore users' acceptance of service robots and their willingness to use them from three dimensions of functional needs, social emotional needs and relational needs, and found that functional needs have the most significant impact on the acceptance and use of service robots. 6. Go et al. (2020) used the interactive technology acceptance model to study users' acceptance of robots. Based on the technology acceptance model, four variables of perceived interactivity, perceived entertainment, self-efficacy and social norms were added, and a total of six variables affected users' acceptance of robots. 7. Xu Liying and Yu Feng (2020) believe that in the process of human-computer interaction, in addition to the characteristics and attributes of the robot itself, the willingness of the robot to continue to use will also be affected by the characteristics of the user. 8. Robot acceptance is also influenced by user gender (Kim et al.2019)	Yu(2019) Hsiao et al. (2022) ZhangYi et al. (2022) Sage et al. (2023) Wirtz et al. (2018) Go et al. (2020) Xuliying,Yufeng (2020) Kim et al.(2019)

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