Analyzing The Smart Elderly Care Based On Internet Of Things

Ke Xu
(Department of E-commerce, Shenzhen Campus, Jinan University, China)

Abstract: *The phenomenon of population aging in China is becoming more and more serious, and the traditional model of elderly care can no longer adapt to the development of modern society. To better meet the needs of the elderly in all areas, this paper analyzes the application of Internet of Things(IoT) technology in smart elderly care(SEC). On the basis of the IoT, smart elderly care can improve service efficiency and provide personalized services for the elderly. Although there are some shortcomings and problems, after the improvement, it can provide better solution to the problem of population aging, satisfy the diverse and individualized needs of the elderly and improve the life standard of the elderly.*
Key Word: *Internet of Things; smart elderly care; population aging*

I.   Introduction

As society advances and medical and health conditions improve, the average lifespan of people has been extended, and simultaneous fertility decline, leading to a gradual increase in the proportion of elderly population. The phenomenon of population ageing has become increasingly serious. In 2010 Sixth National Population Census, the proportion of people aged 60 years and over was 13.26%, and the proportion of people aged 65 years and over was 8.87%; in 2020 Seventh National Population Census, the proportion of people aged 60 years and over was 18.70%, and the proportion of people aged 65 years and over was 13.50%[1]. The traditional model of elderly care requires a large amount of manpower and material resources, and nursing homes have tight beds and a shortage of medical staff, which cannot meet the growing needs of the elderly. The contradiction between supply and demand is serious. Society's concern about the issue of elderly care is increasing. Moreover, there has been an increased demand for higher standards in elderly care services, and the rapid development of the IoT and other technologies provides technical support for the SEC. As a result, the smart elderly care based on IoT came into being.

II.   Synthesis of Research

Smart Elderly Care

Smart Elderly Care refers to the combination of modern technology and elderly care services through intelligent and informative Internet platforms and devices, using advanced technological means such as information technology, communication technology and artificial intelligence to monitor the physical data of the elderly, broaden their social scope, and provide them with more convenient, comfortable, personalized and safer elderly care services, thus promoting the healthy, happy and independent life of the elderly. In contrast with traditional elderly care, SEC takes information technology as the carrier, breaks the limitation of time and space, promotes novel media social technology to the elderly, allows the elderly to visualize their body data, reduces the psychological anxiety of the elderly, and meets their physiological and psychological needs[2].

Internet of Things Technology

The IoT is a network system that enables objects to connect with each other and communicate and interact with the Internet through various physical devices such as radio frequency identification devices, sensors, and other technical means such as software and networks. The core concept of IoT is to connect various smart devices, sensors and objects through the Internet to realize data collection, transmission, processing and application. These objects can be smart home devices in daily life, sensors in industrial production, navigation systems in vehicles, and even systems such as smart transportation and environmental monitoring in cities. The IoT is often categorized into three levels: sensing layer, network layer and application layer[3]. The IoT technology mainly utilizes the sensing layer to perceive and acquire the information of objects, the network layer to transmit the data, and the application layer to fulfill real-time monitoring to realize the communication between objects and people, objects

and objects, and to provide users with various services, and thus to meet the people's needs in all aspects. The essence of IoT is to promote the integration between human society and physical systems by embedding various objects with intelligent characteristics. By utilizing this approach and technology, individuals can achieve the continuous monitoring of different machinery, equipment, and infrastructure, thereby enhancing the effectiveness of production and daily activities[4].

Existing Problems

During the course of practicing the SEC model, there are inevitably some problems.

The first is the problem of financial pressure: SEC requires a certain amount of investment to purchase equipment and service, which puts a great deal of financial pressure on economically disadvantaged families.

Secondly, there is the issue of the acceptance of technology by the elderly: older persons generally have a relatively low level of acceptance of new technologies, and in particular may have obstacles during the use of digital technologies and smart equipment. This leads to the problem that older persons may face barriers to the use of technology in the promotion and implementation of the SEC model, resulting in a digital divide.

The next issue is the security of related information and data: the SEC model needs to collect relevant health information of the elderly, such as living habits, location information, health records and so on. The system needs to keep the information strictly confidential. If the system lacks certain security measures, it is bound to face the high risk of malicious leakage of personal information[5].

The last is the issue of humanistic care for the elderly: in the process of building SEC model, many experts and scholars focus on elevating the level and quality of elderly care services, neglecting to give adequate humanistic care to the elderly, resulting in a lack of understanding of the psychological and spiritual state of the elderly; the elderly's excessive reliance on convenient services and functions brought by the technology may reduce the interpersonal communication and interaction, leading to loneliness and the emergence of mental problems.

III. Feasibility Analyses of Smart Elderly Care

Technical Support

The IoT support technologies include microelectromechanical systems, embedded systems, software and algorithms, power and energy storage, and new material technologies.

Microelectromechanical systems are interdisciplinary and widely applicable mechanical systems developed based on integrated circuits and micromachining technology, able to manufacture mechanical and electronic components with micron size. Based on their functional design, they are mainly divided into micro-sensors, microactuators, micro-mechanical devices and so on, realized miniaturization and intelligence[6].

Embedded systems usually consist of hardware components such as processors and memories, and software components such as embedded operating systems, which are used to control, monitor, and perform specific tasks or functions.

Software and algorithms are the main technologies that realize IoT functions and determine IoT behaviors. Software is responsible for controlling and managing IoT devices such as sensors, including embedded software, cloud applications, and mobile applications; algorithms process and analyze data, extract valuable information from them, and realize intelligent decision-making and autonomous behaviors, such as automation control in smart homes.

Power and energy storage play a crucial role in the IoT, where a sea of devices and sensors require a stable and reliable power supply, and energy storage technologies are also needed to cope with power outages or temporary blackouts, recycle energy, balance energy supply and demand, and achieve environmental friendliness.

New materials technologies refer to the emergence of new materials and related technologies in the field of materials science. These new materials such as carbon nanomaterials, photonics materials, and flexible electronic materials have unique physical, chemical, or structural properties that can lead to improved sensor-related performance.

Policy Support

Recently the phenomenon of population ageing has become increasingly prominent in China, and the government has enacted a series of policies to address this challenge.

In 2013, a special action plan for the development of the IoT explicitly proposed to "organize and implement the national demonstration project for the application of the IoT for SEC"[7].

In 2019, the Opinions on Promoting the Development of Elderly Services proposed to "continue to promote the development of the smart health and elderly care industry, expand the application of information technology in the field of elderly care, formulate a catalog for the promotion of smart health and elderly care products and services, and carry out pilot demonstrations of smart health and elderly care applications"[8].

In 2021, The "14th Five-Year Plan" for the Development of the National Aging Career and Elderly Service System stated "implement the national strategy of actively coping with the aging of the population".

Our government has introduced so many extremely forward-looking, constructive and highly instructive policies as mentioned above, which have promoted the rapid enhancement of SEC technology and services, and facilitated the innovation and advancement of the SEC industry as a whole.

IV. Integration of Internet of Things Technology And Smart Elderly Care
Smart Health Monitoring

A smart health monitoring system is a system that utilizes technologies such as the IoT, sensors and data analytics to monitor and collect health data from older persons in real time. The principle is to collect various health indicators and data by associating sensors and devices with an individual's body or environment, and then transmit the data to a central processing unit for analysis and interpretation, ultimately providing personalized health management and monitoring services for the elderly.

Through sensors, elderly individuals can monitor their real-time physiological parameters such as heart rate, blood pressure, blood glucose, body temperature, and gain insights into their own health conditions. By tracking information such as step count, the activity level and intensity of elderly individuals are recorded, encouraging them to maintain an active lifestyle. set up health reminders and alerts, such as reminding seniors to take medication and engage in exercise. Once a sharp change in the seniors' health data occurs, the system can send out an alarm to notify his/her loved ones and medical personnel, so that the safety of the elderly can be guaranteed at the first time.

Smart Home

Smart home technology and equipment refers to the application of the IoT, sensors, wireless communications and intelligent control technology to the home environment, giving home equipment and systems the ability to calculate and communicate, and realize the interaction between information through network information technology, so that home equipment and systems can be automated, remotely controlled and intelligently managed. With the help of smart home technology, automated control of home equipment can be realized, automatically controlling curtains, door locks, adjusting light brightness and so on. According to preset conditions, it can provide comfortable experience for the elderly. Smart home technology not only has the traditional function of living, but also has a comprehensive information exchange function. Through the connection of cell phones and other devices, we can remotely control the home equipment and check the relevant situation, so that the children understand the living conditions of their parents, which ensures the smooth information flow within and outside the family, and also realizes the protection of "people-oriented" home life for the elderly[9]. Smart home technology also has the function of security and monitoring. By utilizing devices such as the intelligent camera, door and window sensors and smoke detectors, it can monitor the indoor temperature, humidity, carbon monoxide content and so on. This helps to prevent incidents such as fires and gas leaks, ensuring a safe home environment for the elderly.

Telemedicine

Elderly people may not be able to travel to hospitals for medical treatment due to physical inconvenience or lack of company. Telemedicine eliminates time and geographical restrictions, enabling elderly people to obtain medical services anytime and anywhere and reducing the burden of elderly people's traveling. Regardless of whether elderly people are in the city or in remote areas, they can obtain high-quality medical services with the help of telemedicine. Elderly people can have video consultation or text communication with doctors through computers, cell phones and other devices, seeking nutritional guidance, lifestyle advice, psychological support and so on. Through a secure network connection, doctors and elderly people can share medical data such as cases, examination reports and image data, which enables doctors to have a more comprehensive understanding of the elderly's condition. Doctors can also collaborate with other doctors through the remote platform to discuss and treat complex cases. In addition, remote surgery is also of great significance for the elderly, which allows them to obtain high-quality surgical services, enjoy the most advanced medical technology and equipment, and ensure the quality and safety of the surgery. By combining with sensors and other devices, hospitals and senior care institutions have realized the information interoperability and regular consultation, and doctors can remotely observe the health of the elderly by using wearable technology[10], timely adjust the treatment plan, which helps to provide personalized health management and guidance to improve the life standard of the elderly.

V. Policy Recommendations And Future Optimization of Construction

To address the issue of economic pressure: implement economic subsidies and support for the SEC model, such as subsidy schemes provided by the government and funding programs for social welfare agencies. The government can work with relevant enterprises to promote price rationalization, such as setting price guidelines and promoting market competition, so as to reduce the economic pressure on users of the SEC model.

To address the issue of technology acceptance: increase investment in advertisements to publicize and popularize the value and benefits of SEC. Design interfaces and methods that are simple, intuitive, and easy for the elderly to understand and operate, avoiding complex terminology and operating steps. Provide clear guidance to reduce the obstacles for the elderly in using new technologies. Cooperate with relevant organizations or service providers to provide training courses on SEC technology, including basic operations, operating steps of common procedures, safety precautions and so on. Set up an online platform for technical consultation for the elderly to improve their acceptance of and ability to use SEC model.

For the security of information and data: clarify the rules of industry access and borrow the law to delineate the bottom line of the profession. Delineate the scope of responsibility and authority, and increase the punishment for violations[11]. Establish a strict data privacy policy that clearly specifies the ways in which information about the elderly is to be collected, used and shared, and ensures that the personal information of the elderly is collected and used only when necessary. Adopt technical means such as data encryption, access control and security authentication, to ensure the security of the personal information of the elderly in the process of transmission and storage. Provide information security training and anti-fraud education to teach the elderly how to deal with various means of online fraud, and to raise the security awareness of the elderly.

To address the humanistic care issues: organize mutual aid activities and experience sharing among the elderly, so that the elderly can communicate with and help each other. Add social functions such as online social platforms and virtual communities in the SEC model and encourage the elderly to participate in social activities and keep in touch with their families, friends, and the community, so as to improve their social interactions and reduce the sense of social isolation. Cultivate professional, caring, and patient caregivers and service personnel, provide a humanized service model, personalized care and attention, focus on the physical and mental health of the elderly, and develop a system that is closer to the elderly[12]. Enrich recreational activities under the mode of SEC model, such as reading of famous books, music appreciation, drama viewing, etc., to satisfy the recreational needs of the elderly, so as to enable them to enjoy the fun of life.

VI. Conclusion

In summary, with the continual advancement of IoT technology, SEC has also realized rapid development. The SEC industry based on the IoT has enormous potential, to provide efficient and convenient elderly care services and improve the life standard and health of the elderly. However, it is also necessary to comprehensively consider the above problems and solutions such as privacy and security, focus on the emotional needs and interpersonal relationships of the elderly from the practical perspective of their lives, and provide personalized services to help the sustainable development of smart elderly care model.

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