Design of Home Care System For Rural Elderly Based on Artificial Intelligence

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Abstract. With the development of Internet of Things technology, cloud computing technology, big data technology, and artificial intelligence technology, the application of these new technologies to rural life can help rural elderly care at home. The home care system for the elderly in rural areas is based on artificial intelligence technology and uses the Internet of things technology to collect real-time environmental parameters at home and to optimize the living environment. It uses intelligent image recognition technology to judge the behavior of the elderly and interlopers and gives effective early warning and alarm. It uses wearable devices to measure the health of the elderly in real-time. It uses the man-machine dialogue program to solve the life needs of the elderly to improve the well-being of the elderly life. It integrates big data and cloud computing technology to process the collected information.

Keywords: Artificial intelligence, Home care, Internet of Things technology, Big data, Cloud computing intelligent greenhouses, early warning, control system, cloud computing

1. Introduction

China is facing demographic changes and aging is accelerating, according to the national official data, by 2019, the population over 65 years old accounts for 12.57%, the dependency ratio of the elderly is 17.8%. The rural population accounts for 39.45% of China's total, however, the aging of the rural population is always higher than that of the urban population.

In recent years, the rural population has gradually moved to the cities, especially young people to buy houses in the cities. In rural areas, the transfer of young people to cities has left most old people living in rural areas alone. These elderly people are basically unable to work. They live far away from hospitals, banks, and supermarkets, and lack convenient means of transportation, causing
inconvenience in life and hidden health and safety risks. In the era of AI and the advent of the 5G era [1], in order to effectively solve a series of social problems related to the elderly in rural areas, a rural home care system based on artificial intelligence has been developed. The application of artificial intelligence to home care can realize the combination of the Internet, smart wearable and intelligent monitoring, and increase the operability of home care services. By using the user data collected intelligently, it can help government departments or pension service institutions to improve efficiency, create conditions for the interaction and communication between the elderly and their children, improve the stickiness and satisfaction of the elderly users, and extend the depth and breadth of services. In the era of artificial intelligence, home-based care will realize "intelligent care and quality care" [2].

2. The system structure
This system is based on artificial intelligence with excellent learning ability and decision-making ability as the core control center [3]. The rural elderly home care intelligent system can use various sensors to collect the home’s temperature, humidity, gas concentration, and other information. Heart rate, blood pressure, body temperature, sedentary alerts, sleep quality assessments and activity tracks are recorded in real-time for the elderly through wearable devices. The intelligent camera can be used to capture the behavior and movements of the elderly in real-time, judge sudden illness, fall, change of mentality, and stranger intrusion for early warning and alarm. Using the Man-machine dialogue module of Android terminal, intelligent voice chat, making phone calls, online goods ordering, online medical consultation, and voice alarm services can be realized. At the same time, big data and cloud computing technologies are used to store, process, and process all kinds of collected data, so as to realize information push and early warning [4].

Rural elderly endowment system is based on the artificial intelligence technology that occupies the home, using intelligent image recognition and speech recognition, Integrate the IOT technology, big data, and cloud computing to detect and control the living environment, realize safety protection, health supervision, intelligent voice, speech online shopping, online company doctor visits, a key alarm, data analysis, and information push, early warning, and remote view, etc.

By setting up sensors, IOT technology is used to collect data such as temperature, humidity, light intensity, combustible gas concentration, and carbon monoxide concentration in homes [5]. Through the installation of an intelligent camera, the raspberry Pi application development board with artificial intelligence technology is used to process the collected images and compare and analyze the target behavior. Wearable devices, such as smart bracelets, are used to collect the daily health test data of the elderly. Through the human-computer interaction terminal and the use of artificial intelligence technology, the intelligent network platform is automatically connected to respond to the elderly's corresponding requests, such as voice chat, online shopping, an online medical consultation, and so on.

The real-time environmental data, image information, health data, and inquiry request are transmitted to the cloud platform through a wireless network. Gateways and interfaces store, analyze and process the received data, push the information., then give early warning and alarm processing when the alarm value reaches the threshold.
Data acquisition, network transmission, data processing, and scene application constitute the rural elderly home care system, as shown in Figure 1.

![Figure 1](image)

**Fig. 1** Structure diagram of home care system for rural elderly based on ARTIFICIAL intelligence

2.1. **Hardware devices**

The temperature and humidity sensor is used to measure the temperature and humidity in the home, combining different seasons, different periods of time, and the sensitivity of the elderly to temperature and humidity, the artificial intelligence technology is used to carry out corresponding automatic or remote control of household appliances such as air conditioner, ventilator, and humidifier, so as to achieve a comfortable living environment.

The light sensor is used to detect the room’s intensity. Combined with the activity time of the elderly, artificial intelligence technology is used to adjust the light of the intelligent curtain and lighting system accordingly, so as to provide the elderly with a bright field of vision or an ideal sleeping environment.

The combustible gas detector can detect natural gas or gas in the kitchen. If the combustible gas is left off or leaked, the valve can be automatically closed and the exhaust fan can be turned on to ensure the safety of the gas.

The carbon monoxide concentration sensor will detect the room’s CO-concentration. After reaching the threshold, turn on the exhaust fan and respond to the alarm to prevent CO poisoning caused by insufficient heating in the wall hanging furnace or charcoal stove in winter. The structure is shown in Figure 2.
Using the image recognition technology of artificial intelligence, the intelligent camera can monitor the elderly at home in rural areas in a comprehensive and multi-angle in real-time. It can automatically connect to the network to detect the sudden disease, fall, change of mentality, and other dangers caused by the old and infirm and give an automatic alarm. Community hospitals and children can receive alarm information in real-time. It can also be used as a warning against strangers breaking into your home. The children can check whether the elderly take medicine on time, eat on time, work and rest on time, exercise properly, sit for a long time, smoke, drink, and other bad habits by logging in the background or monitoring on the application terminal, and voice family reminder. Safety alarm equipment and functional structure, as shown in Figure 3.

![Diagram of living environment detection equipment](attachment:image)

**Fig. 2** Living environment detection equipment

**Fig. 3** Safety alarm equipment and functions
The wearable device monitors the heart rate, blood pressure, body temperature, sedentary behavior, sleep quality, and activity tracking of the elderly in real-time collects daily health detection data, and transmits them to the cloud platform for data storage, processing, and application, so as to establish health archives for the elderly. Health status detection equipment and functional mechanism, as shown in Figure 4.

![Health status testing equipment and functions](image)

**Fig. 4 Health status testing equipment and functions**

Human-computer interaction terminal is the android devices which has loaded the APP, using artificial intelligence speech recognition technology, the automatic connection of intelligent network cloud platform, responding to the corresponding voice request of the elderly, can realize to dial telephone, voice chat, voice broadcast, voice control of the switch, online shopping, online doctor visits, and other functions. The human-computer interaction device and its functional structure are shown in Figure 5.
2.2. **The background in the cloud**

Big data and cloud computing are used in the background. With the help of the Ali cloud platform, the relevant information collected is processed and the corresponding structure and processing method is fed back to the human-computer interaction terminal to realize man-machine dialogue, remote control, and other functions. Information collection terminals include residential environment detection equipment, safety alarm equipment, and health status detection equipment, etc. [6].

In order to solve the storage of large amounts of data and complex computing problems, Ali Cloud online public service is used to provide safe and reliable computing and data processing capabilities for the rural elderly home care system, so as to enable the intelligent control, early warning, and monitoring to operate efficiently.

2.2.1. **Equipment access**

First, run the SDK to obtain the target device architecture. Then write the system docking function and call the system docking function to complete the application for the release and specific use of OS resources. Finally, the cloud on MQTT is used to establish the channel between the device and the cloud platform to realize device connection.

2.2.2. **Communication equipment**

MQTT protocol is applied to transmit the relevant data obtained by Raspberry PI to the IOT platform through a wireless transmission network. The information is processed and then sent to the Android terminal.

2.2.3. **Equipment management**

Use the built-in triplet in the demo to improve and connect the Platform of the Internet of Things, log in to the console of the platform to create products, create new devices on the device management page, and connect to the platform of the Internet of Things after setting parameters.

2.3. **The Android client**

![Diagram of Human-computer interaction devices and functions](image-url)
At present, smartphones have been popularized in rural areas, and users can cooperate with the use of the cloud without buying client hardware devices. Android mobile phone system has high-cost performance, strong applicability, and strong popularization, which is superior to the expensive IOS system.

By downloading an Android mobile phone APP, entering relevant account information, and logging into the "Rural Elderly Home Care System", the elderly user terminal can conduct voice dialogue. The user terminals of children can view all kinds of real-time data of home environment, health and safety of the elderly sent by the monitoring platform, receive early warning information, conduct remote control and view videos, etc.

3. Conclusion
Based on artificial intelligence technology, this paper designs an intelligent old-age care system aiming at the social problems of the rural elderly in China's aging era. This system takes advantage of raspberry PI's powerful functions and extended uses and other features, combines the Internet of Things technology, and integrates the collected information into the cloud computing platform, which can realize real-time storage, computing, and processing of data. Android users can realize information retrieval, early warning and prevention, and security and control. Android terminal devices can realize information checking, early warning, and prevention, security, and control. Artificial intelligence is applied to the home care of the elderly in rural areas, assisting the daily life of the elderly, taking care of their daily life and living, reassuring their children, and ensuring their personal safety [7], so that they can spend a happy and healthy old age. It not only carries forward the fine tradition of respecting and loving the elderly of the Chinese nation but also reflects the humanistic care that the elderly should be cared for, supported, and enjoyed.

References
[1] Ke Y and Zhitao W 2020 Research on the construction of community home-based care service model with artificial intelligence J. Journal of yunnan university of administration 22 pp 145-152
[2] Guoping D and Xinshi C 2019 Research on the Application Trend of Artificial intelligence in home care under the background of "Internet +" J. Enterprise Technology and Development 03 pp 88-89
[3] Dangchen S and Xingchen L 2020 Analysis on the applicability of artificial intelligence for home care J. Journal of xi 'an university of finance and economics 33 pp 27-36
[4] Xiaorui Z, Wenqiong D, Shijie P, Weigang W, and Zhi L 2017 Analysis and research on community elderly intelligent medical service system -- based on "Internet +" and big data analysis technology J. Fujian computer 33 pp 144-145
[5] Hui X 2018 Research on multi-sensor Protocol Fusion Technology D. Shenyang University of Technology
[6] Chun S 2013 Influence of intelligent Transportation on building smart Cities J. Transportation World (Transport. Vehicles) 05 pp 88-89
[7] Yuan G 2018 Development Status and Policy Research of smart Pension D. Shandong University of Finance and Economics