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Research on Home-based Elderly Care System Based on 5G Technology and Edge Computing

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Abstract: This paper connects the Internet with health and elderly care, and puts forward a new home-based elderly care system to realize all-round elderly care and service standardization. In this paper, the fuzzy analytic hierarchy process is used to construct the credit evaluation index system of pension institutions and determine the index weight. The long-term and short-term memory network based on artificial intelligence technology is used to construct the credit evaluation model of pension institutions supporting intelligent supervision. Combined with 5g technology and edge computing, the bearing of deep learning network algorithm in artificial intelligence is realized.

1. Introduction

In the era of "Internet plus", linking the Internet with health and pension is irreversible trend. At present, the regional distribution of the development of China's smart elderly care industry is uneven, and high-quality enterprises are still concentrated in the economically developed eastern regions. The elderly care products of different regions and institutions are quite different, and the standards are not unified, resulting in a great waste of resources, which is not conducive to the implementation and management of the specialization and unification of home-based elderly care by government departments, it restricts the large-scale development of the intelligent elderly care industry. At the same time, under the new pension model, strengthening the guidance and supervision of civil affairs departments on pension institutions, establishing and improving pension service evaluation, trustworthy incentive and dishonest punishment are also the key work that government management departments need to carry out at present.

2. Home-based elderly care system

The platform provides the functional modules of the following subsystems, which are customized and developed according to the needs of government market users and market users of elderly care institutions to provide services for the elderly.

(1) The service subsystem of "no wall nursing home" coordinates community doctors to provide on-site visit, family hospital bed, home rehabilitation care and other services for the elderly who are seriously ill, disabled, partially disabled and have difficulty in moving. There is no need for the traditional "call center" The function of the call center is transformed into the application of artificial

intelligence technology. All the needs of the elderly can be delivered to the management end of the "wallless nursing home" by means of one click voice. The information management platform automatically collects and identifies the service needs of the elderly, and synchronously and automatically sends the needs of the elderly to the employees of the service enterprise to provide services for the elderly, at the same time, the system automatically has the processes of check-in, check-out and service quality monitoring for service personnel. The function of low operation and large service range of "wallless nursing home" can be realized with the minimum investment cost.

(2) "Time bank" Shared subsystem. The key to solving the pension problem is to establish a self-protection system for low-income aging groups. Based on the theory of shared economy and behavioral finance, the platform constructs a time bank pension system including the quantification of time mutual assistance services, time value system and inheritance system of time savings. Combined with the current community information construction, the corresponding "time bank" management information subsystem is developed by using the cutting-edge blockchain technology, and professional social worker posts are set in the community to provide home daily service functions: including domestic service, life care, going out escort, spiritual comfort, purchasing and paying on behalf of others. Manage the operation of the "time bank" system, realize the resource sharing of time bank depositors in various communities within the region, strengthen inter community cooperation and gradually expand the effective resources of the community.

(3) Management and evaluation subsystem of elderly care institutions. In accordance with the law of the people's Republic of China on the protection of the rights and interests of the elderly The civil affairs department shall be responsible for the guidance and supervision of elderly care institutions, establish and improve the credit evaluation knowledge base of elderly care service credit evaluation, trustworthy incentive and dishonest punishment, and design a credit evaluation model based on fuzzy analytic hierarchy process and machine learning, so as to provide decision support function for the government Civil Affairs Department to carry out intelligent supervision and evaluation of elderly care institutions. In addition, the subsystem also provides the management functions of civil affairs departments for elderly care nurses, including training management, professional skill identification management and evaluation.

(4) Health management subsystem. It provides health protection services such as electronic health file collection and sharing, cloud health lectures, etc. the elderly can automatically upload health data to the cloud through a variety of health devices, such as sphygmomanometers, and store and file them. The data report can be shared with the guardian in real time, so that the guardian can understand the health status of the elderly at the first time Kang data is also shared in the background of the information management subsystem of "no wall nursing home" or "no wall nursing home", which automatically establishes the health files of the elderly with one click. The health status of the elderly is shared and managed to the greatest extent through "no wall nursing home", and gradually forms a prevention, treatment and treatment system covering the whole life cycle of community families Integrated e-health security service for rehabilitation and health management.

(5) The disease risk analysis subsystem establishes various common diseases based on the elderly health files and data stored in the platform cloud the risk assessment model for (especially chronic diseases) seeks to cooperate with community hospitals and third-party physical examination institutions to provide disease risk analysis function based on big data. In case of abnormal health data of the elderly, the platform will automatically send early warning information to the community hospitals or doctors registered by the elderly, and medical staff will provide medical assistance services for the elderly online or on-site in time Taiwan will also directly purchase third-party monitoring equipment and its API access platform terminal to realize video monitoring and fall alarm of the elderly's home situation. In case of the elderly falling, the platform will immediately notify the community hospital or doctor registered by the elderly, and the medical staff will provide medical

assistance services for the elderly online or on the door in time.

(6) Public health public opinion information subsystem. It provides the function of pushing information such as early warning of public health emergencies and behavior suggestions for the elderly. The subsystem collects real-time public health event news published by mainstream official media through thematic public opinion crawler technology, monitors the public opinion of thematic events in the field of public health, in the form of mobile information scroll bar, SMS notification, etc Timely push the information such as early warning and behavior suggestions of local government departments to the elderly and relatives.

3. Innovation model

(1) Integrated "wallless nursing home" model based on "government + Society + public"

The idea of "no wall nursing home" is introduced to build a set of integrated home-based elderly care management mode of "government + Society + public" for the government - "no wall nursing home". As a new way of providing for the aged, the elderly can choose and enjoy professional elderly care services and related social resources at home, and can enjoy all services in the traditional nursing home without leaving home. "Wallless nursing home" combines the advantages of home-based nursing and institutional nursing. By providing xinyileling home-based nursing management platform, it coordinates community doctors to provide door-to-door visits, family beds, home rehabilitation care and other services for the elderly who are seriously ill, disabled, partially disabled and have difficulty in moving. "No wall nursing home" can also reduce the cost of government pension, reduce the burden of children's pension, improve the quality of life of the elderly and promote the development of pension industry.

(2) Regional "time bank" system based on shared ledger

① The platform applies blockchain technology based on shared ledger. Make full use of the advantages of blockchain decentralization technology, information tamperability and high security, and use cutting-edge information technology to solve the credit problems involved in the "time bank" system.

② The platform designs a multi role and multi-level regional "time bank" management mechanism. Support various user roles and multi-level management such as volunteers, volunteer teams and managers of civil affairs departments in various regions to meet the needs of universal deposit and withdrawal in the future.

③ The platform develops a flexible and easy-to-use system terminal. "Time bank" is divided into two parts: applet front end and web management background. Users have low threshold for use, the product has powerful functions, and supports custom volunteer activities.

(3) Credit evaluation technology and method of elderly care institutions based on intelligent supervision

The civil affairs department can collect the daily service information of elderly care service institutions through xinyileling home care management platform, build the credit evaluation index system of elderly care institutions and determine the index weight through fuzzy analytic hierarchy process, Long and short term memory network based on artificial intelligence technology (LSTM) build a credit evaluation model of elderly care institutions supporting intelligent supervision, evaluate the credit of elderly care institutions from three indicators: target level, project level and index level, and the evaluation results can be directly loaded into the credit file of the institution. The evaluation technology has low overall relative error, high accuracy and intelligence, ensures the significance of comprehensive credit evaluation of elderly care institutions, and provides The Civil Affairs Bureau and other management decision-makers provide reliable basis.

(4) Platform design pattern using microservice architecture

Xinyileling home care home care management platform is designed based on the micro service architecture. The platform puts the associated business logic and data together to form an independent boundary. Its purpose is to provide terminal applications faster without affecting other application components, making the system easy to maintain and upgrade.

① Componentization of applications through services: In the micro service architecture, components are defined as software units that can be independently replaced and upgraded. In the application architecture design of xinyileling home care home care management platform, the component design is carried out by dividing the overall application into micro services that can be independently deployed and upgraded.

② Product rather than project mode: The traditional application mode is to develop complete applications in project mode and deliver them to the operation and maintenance team after development; The micro service architecture of xinyileling home care home care management platform adopts the integrated method of integrating development and operation and maintenance, and runs the "micro service" through the whole product life cycle.

③ "Decentralized" governance and data management mode: Unlike holistic applications, which often use a single technology platform, microservice Architecture tends to find technologies that have successfully solved similar problems. Xinyileling home care home care management platform integrates each component module and uses appropriate tools to complete the tasks of each module. At the same time, the platform also adopts a diversified and persistent data access method to allow each micro service to manage its own database.

4. Key technology

4.1 Blockchain and 5g Technology

As an important driving force leading the innovation of digital economy, 5g technology is building a new era of global IT infrastructure together with artificial intelligence, blockchain, cloud services and big data with its high-quality characteristics such as high throughput, low latency, high concurrency and low power consumption. The Internet of things extended by 5g will help to improve the efficiency of the whole society and promote the large-scale rise and prosperity of Internet of things, artificial intelligence, edge computing, augmented reality (AR), virtual reality (VR), ultra-high definition video streaming and other applications.

The emerging blockchain technology provides an innovative and effective way to solve the above problems. In short, 5g technology is the infrastructure of the future network, and blockchain is a new framework for business development. How to closely integrate blockchain with 5g technology is the key research topic of blockchain designers.

At present, 99.99% of the trillions of commodities in the world are not connected to the blockchain, one of which is due to the immaturity of the terminal. Many blockchain industrial applications that rely on IOT terminals cannot be commercialized, including cloud VR / AR, intelligent security, Internet of vehicles, intelligent city, intelligent manufacturing, UAV, sd-wan + NAS, mesh products, edge computing modules, etc. 5g technology can bring wider coverage, more stable authorized frequency band and more unified standards to the Internet of things, so as to provide strong support for blockchain applications based on the Internet of things. Therefore, relying on the high-speed 5g technology and the development of various technologies such as the Internet of things, big data and artificial intelligence, the blockchain will be able to provide stable tracking, traceability and distributed point-to-point trading functions for trillions of commodities around the world.

In order to meet the above technical requirements and provide many conveniences for 5g, HSN proposes a perfect "blockchain + 5g" solution for blockchain. The HSN technical architecture is

shown in Figure 1. HSN provides an integrated distributed ledger system with seamless access to 5g network, including complete distributed deployment architecture, smart contract system, security system and hierarchical consensus mechanism, which can meet the needs of complex decentralized application scenarios with 5g high throughput and high performance, and give birth to the business ecology of 5g block chain.

The product provides an elderly care service platform based on blockchain technology, which includes a service area and a background area. The service area includes a medical module, an entertainment module, a housekeeping module, a bill distribution module and a security prevention and control module; The backstage area comprises a communication module, a control module, a safety and health management module and a general information platform.

In the process of elderly care services, blockchain technology is used to verify the identity and qualification of elderly care information. The elderly care service construction platform based on blockchain technology integrates medical service resources, entertainment service resources and security prevention and control model service resources. If blockchain technology is not adopted, when elderly care personnel change the elderly care service organization, the connected enterprises or individuals cannot accurately obtain the accurate information of the previous service organization or individual, but use blockchain technology, By accessing the uplink data, we can solve the problems of information asymmetry between the current elderly care service institutions or individuals, greatly reduce the trust cost and improve the efficiency of elderly care services.

4.2 Edge calculation

As a bridge combining network and industry and other traditional industries, edge computing provides important support for the evolution of the Internet of things (IOT), especially the new generation of intelligent IOT (aiot), and promotes the digital transformation and industrial upgrading of intelligent manufacturing, intelligent transportation, environmental protection, government work, public security, smart home, environmental monitoring and other industries, It has important industrial cross-border integration value.

Edge computing refers to a distributed open platform that integrates the core capabilities of network, computing, storage and application at the edge of the network near the object or data source, and provides edge intelligent services nearby to meet the key needs of industry digitization in terms of agile connection, real-time business, data optimization, application intelligence, and security and privacy protection. It can be used as a bridge between the physical and digital world. At the same time, the edge computing Consortium (ECC) and the alliance of industrial Internet (AII) give the corresponding edge computing reference framework. Compared with traditional cloud computing, the deployment functions of terminal nodes in edge computing are very different.

The main idea of this method in the bearing of artificial intelligence deep learning network algorithm is: edge computing side cloud forward transfer recognition results; The cloud transmits error to the edge computing side in reverse. Instead of regarding the edge and the cloud as two independent deep learning networks in the traditional way, the edge and the cloud cooperate. From the mechanism, the two are regarded as two parts of a larger learning network to work together, so as to combine the performance advantages brought by the cloud in training and high computing volume and the rapid response advantages of the edge terminal in reasoning execution.

References

[1] Development status and suggestions of "smart elderly care" in Chancheng District, Foshan-cooperative economy and technology phase 03, 2022

[2] "Double recruitment and double introduction" to boost the high-quality development of elderly care services

--Ma'anshan daily, January 7, 2022
[3] Research on the construction of pension service mode and pension service facility design of Beijing Tianjin Hebei pastoral complex -- Dou Jinhua,Zhang Fangyan, Tianjin University of technology,University of Science and Technology Beijing, December 11, 2020
[4] The construction of Internet plus community pension model in Shuangcheng economic circle of Chengdu Chongqing Area--China West Normal University Journal (PHILOSOPHY AND SOCIAL SCIENCES EDITION), July 3, 2021
[5] Research on rural medical care combined elderly care service system under the Rural Revitalization Strategy -- Guangxi Social Sciences, November 29, 2021
[6] Job satisfaction of rural government and pension concept of quasi elderly -- An Empirical Analysis Based on CGSS data -- Jianghan academic issue 02, 2022
[7] Exploration of integrating college students' voluntary elderly care service into nursing practice teaching--Chinese Journal of modern nursing issue 24, 2018