

# Application Research on a "5G+AI" Smart Elderly Care Service Platform System

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**Abstract.** Facing the growing demand for elderly care services in China, this paper designs a "5G+AI" smart elderly care service platform integrating 5G, AI, IoT, intelligent sensors and other technologies to open up channels for various elderly care providers, promote smart collaboration among service interfaces, service data and service resources, and further realize all-round elderly care support for the elderly at the individual, family and social levels, It provides a new solution to the increasingly serious elderly care problem.

**Keywords:** Smart Elderly Care; 5G network; AI technology; Matchmaker sensor technology.

## 1. Introduction

By the end of 2020, the population aged 60 and above in China has reached 267 million, which was close to 19% of the national population. China has moved from a mildly aged society to a moderately aged society. How to solve the problem of providing for the elderly is a serious challenge facing the whole society. Aging has a huge pressure on the government's social welfare and medical expenditure, and has a profound impact on almost all social fields.

Benefiting from the rapid development of emerging technologies, the application of advanced management and information technology and the comprehensive utilization of government, community, medical institutions and other resources to provide "smart elderly care" services for the elderly has become the general trend of the elderly care industry. At present, the rapid development of smart elderly care needs to solve several major problems at the technical application level: accurate data collection by intelligent equipment, fast connection without delay by network communication technology, artificial intelligence intervention based on big data, etc. With the rapid deployment of 5G network, supported by 5G and AI technology innovation, and combined with the Internet of Things, cloud computing, big data and intelligent hardware, building a "5G+AI" technology smart elderly care service platform which will "coordinated with home community institutions and will be combined with medical care and health care". It can effectively solve several technical problems existing in the current smart elderly care, and provide convenient and caring elderly care services for the majority of elderly groups.

## 2. Application Demand of Smart Elderly Care Service Platform

It is the common responsibility and expectation of the society to enable the elderly to enjoy a healthy, happy and high-quality life in their old age under the concept of "building and sharing together, and making all people healthy" of the healthy China strategy. The elderly groups themselves also put forward higher demands for life services, life care and spiritual consolation. There are a variety of realistic elderly care service needs for the elderly at different ages, from ordinary needs to rigid needs.

Table 1 Application Demand of Elderly Care Service System Based on 5G Network

Classification	Service Content
Home Perception	Health Perception: monitoring of emergencies and physical discomfort of the elderly, health environment monitoring;

Classification	Service Content
	IoT smart home, environment awareness, location query, human perception.
Emergency Assistance	One button call for help and security alarm; Active Rescue: property security notice, elderly and children notice, neighborhood committee notice.
Medical Work	Remote diagnosis, remote surgery, family beds, family doctors; Telemedicine: indicator monitoring, online appointment.
Health Care	Health care services and care; Information service for the elderly and green channel for elderly registration; Health records, health consultation and psychological consultation.
Social Affair	Distance education for the elderly, 5G+VR virtual reality teaching, elderly forum; Life entertainment: Life Interaction.
Financial Service	Old age medical insurance; All in one card service; Asset custody services.

The smart elderly care service system based on "5G+AI" technology combines online services with offline services, and becomes an effective means to improve the quality and efficiency of elderly care services and promote the innovation and upgrading of elderly care models, meeting the business needs of elderly care services in many aspects, as shown in the figure below.

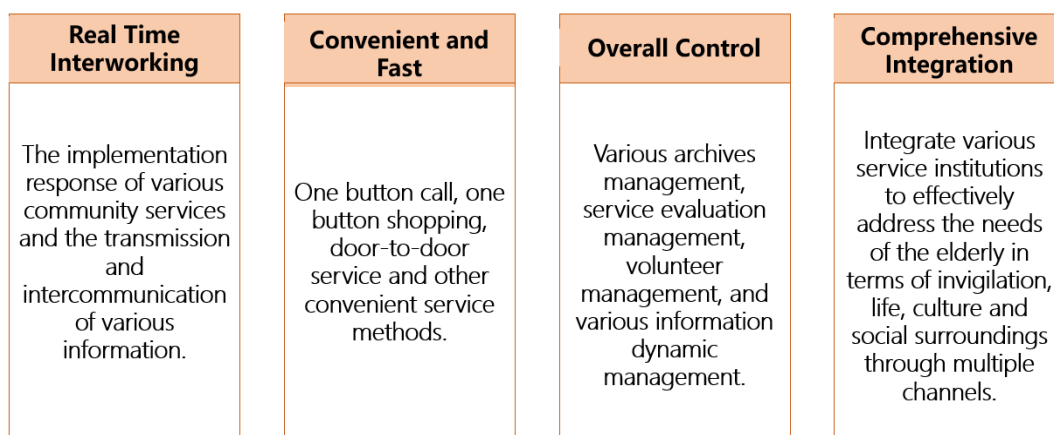


Fig. 1 "5G+Smart Elderly Care Service" Meets Various Business Needs

### 3. Design of smart elderly care service platform based on "5G+AI" technology

#### 3.1 Design architecture of smart elderly care service system based on "5G+AI" technology

The smart elderly care service based on 5G network will change the existing way of information exchange and transmission, and quickly help the medical, home, maintenance, school, products and finance links in the elderly care industry chain to achieve mutual integration and innovation while

achieving connectivity between horizontal and vertical industries, and then effectively combine with customized services, so as to build a smart elderly care service ecosystem of "5G+AI" technology.

The smart elderly care service platform of "5G+AI" technology is based on 5G network, combined with network slicing private network, edge computing, artificial intelligence and other design concepts, and uses 5G network connectivity and edge computing capabilities to move towards a new model of smart elderly care. The smart elderly care service system of "5G+AI" technology is based on a large number of health resources provided by medical platforms, elderly care centers, government agencies, etc., with the core of comprehensive access to the needs of the elderly, and the 5G network as the backbone transmission channel. Through deep integration of the Internet of Things, cloud platform, edge computing, near-field communication (NFC), Bluetooth, ZigBee short distance communication technology, LoRa technology, etc., it provides accurate, high-quality smart health support services. The system architecture can be divided into information perception, network transmission, data resources, Smart service system, regional hospitals, community health centers, elderly care institutions, family doctors, 5G smart ambulance and other elderly care service providers [1], as shown in the figure below.

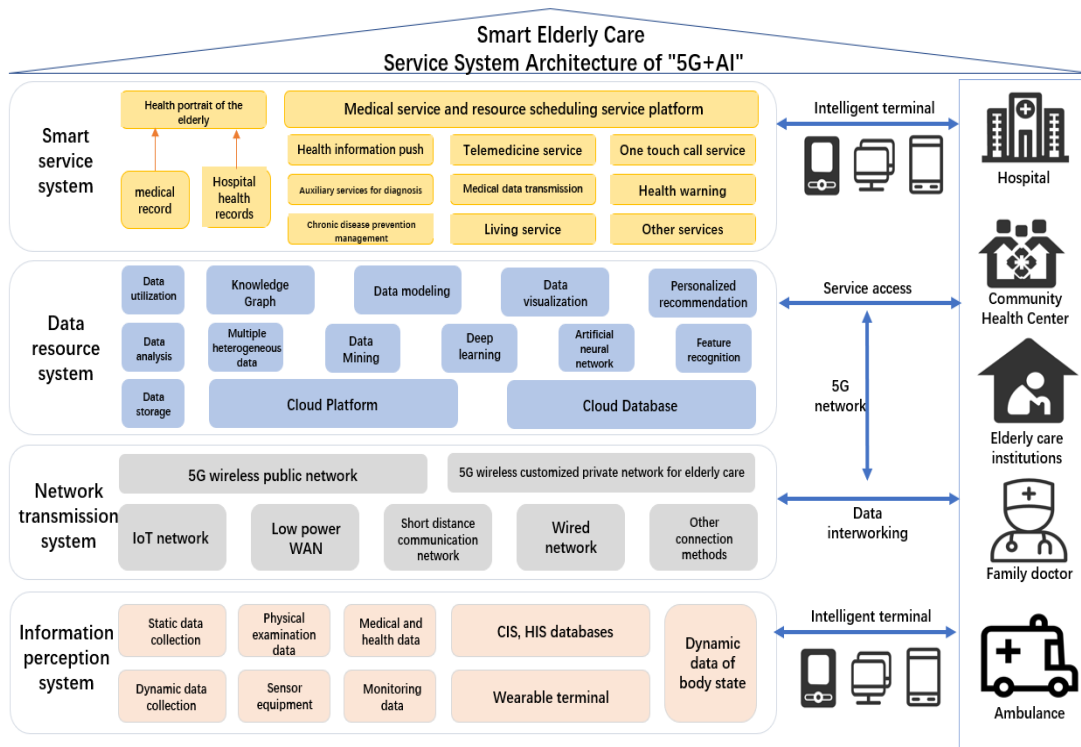


Fig. 2 Smart Elderly Care Service System Architecture of "5G+AI"

(1) Information perception system

The information perception system is the sending end and receiving end of information through various equipment terminals to achieve continuous, comprehensive and rapid information acquisition. They are not only the tools for information collection, but also the carriers on which information applications depend. The terminal perception layer is mainly used to collect the health data of the elderly. The data sources include two aspects. One is the connection and import of static data, including periodic physical examination, routine or sudden diagnosis and treatment data, and the interconnection with various business information systems of regional hospitals; The second is the perception and capture of data generated by the daily activities of the elderly, such as smart wearable devices (bracelets, watches, sensors, etc.), sensor cluster systems (smart home appliances, smart video surveillance terminals, door magnetic induction systems) Medical devices (medical robots, smart phones) and LoRa technology can realize real-time monitoring and efficient upload of the elderly's dynamic health information (location, movement trajectory, blood pressure, heart rate, blood sugar, sleep, environmental information, etc.).

## (2) Network transmission system

The network transmission system can realize real-time, reliable and safe information transmission. It is the transmission medium of information. Through the 5G wireless private network or shared network allocated to different application scenarios, the information transmission between communication subjects can be realized in real-time, high speed, high reliability and ultra-low delay. The network transmission system optimizes, integrates and improves the short distance communication technology, so as to ensure that the transmission network system can respond to various transmission scenarios based on the differentiated transmission mode, further improve the transmission efficiency and save transmission costs. On the one hand, 5G network deployment is carried out through wireless customized private network scheme, named data network (DNN) scheme and uplink classifier (ULCL) scheme to achieve data diversion; On the other hand, a targeted short distance information transmission system is built on the basis of data diversion, including the use of end-to-end network slicing technology, narrowband Internet of Things (NB IoT) and ZigBee short distance communication technology, to achieve accurate information interaction.

## (3) Data Resource System

The data resource system can realize intelligent, accurate and efficient information processing, mainly realizing the storage, calculation and analysis of information. With MEC, AI, cloud storage and other new technologies, it can analyze and process the disordered information, and output valuable information for front-end applications. The data resource system plays a key role in the smart elderly care service system of "5G+AI" technology. The general data platform layer can be composed of data storage, analysis and application. Data storage preliminarily integrates elderly care health data based on extraction → conversion → loading tools, and then realizes the writing and query of specific data through cloud computing platform and cloud database; Data analysis is based on big data, data mining and deep learning technology to realize the identification and modeling of the characteristics of the elderly group and medical and health services, build a knowledge base in the form of feature vectors, and then form a knowledge map of all elderly health information services; In the data application part, based on data modeling and data analysis, the visualization of the knowledge atlas of the elderly group characteristics and medical health service characteristics data is realized, and the personalized recommendation service for the health needs of the elderly group is realized through data annotation, feature matching algorithm and other technical means.

## (4) Smart service system

The smart service system can realize mature, diversified and humanized information applications. It is the concentrated embodiment of 5G value in the smart elderly care service system of "5G+AI" technology. It is the extension of information perception, network transmission and data resource system on the basis of connectivity, integration and optimization, bringing the most intuitive elderly care services and subjective feelings to elderly users. Different smart elderly care service application scenarios can be supported according to the prominent features, such as medical resource scheduling and emergency rescue, remote consultation and medical services, nursing applications, medical diagnosis, identification of early warning health risk factors and smart health monitoring applications.

### **3.2 Composition of "5G+AI" technology smart elderly care service platform and end-to-end networking architecture**

The smart elderly care service platform of "5G+AI" technology consists of four core platforms, seven subsystems and four types of hardware, as shown in the figure below.

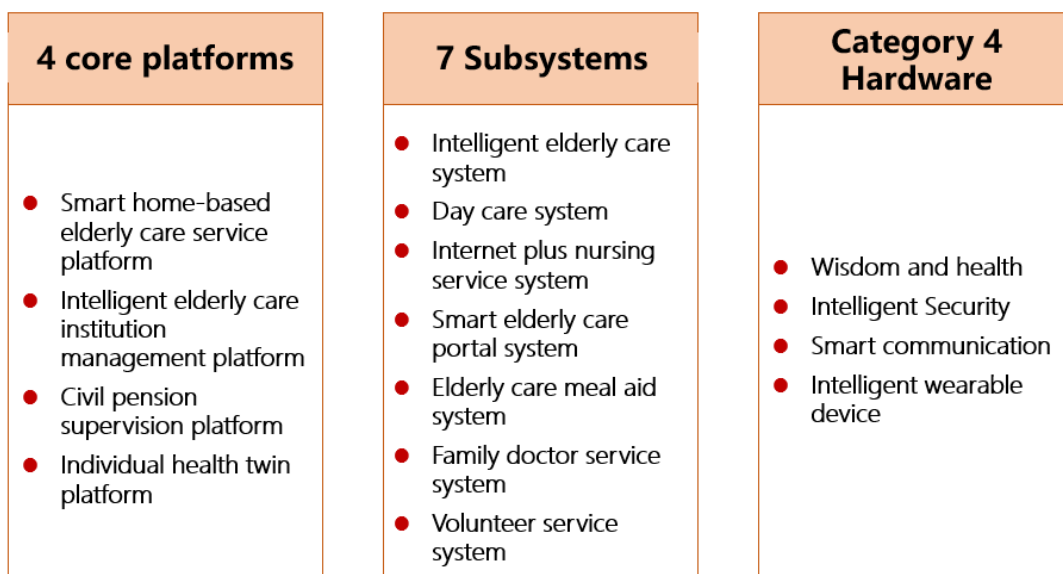


Fig. 3 Composition of Smart Elderly Care System Platform

Build a virtual 5G wireless private network for the elderly based on network slices, and its end-to-end network structure is shown in the figure below.

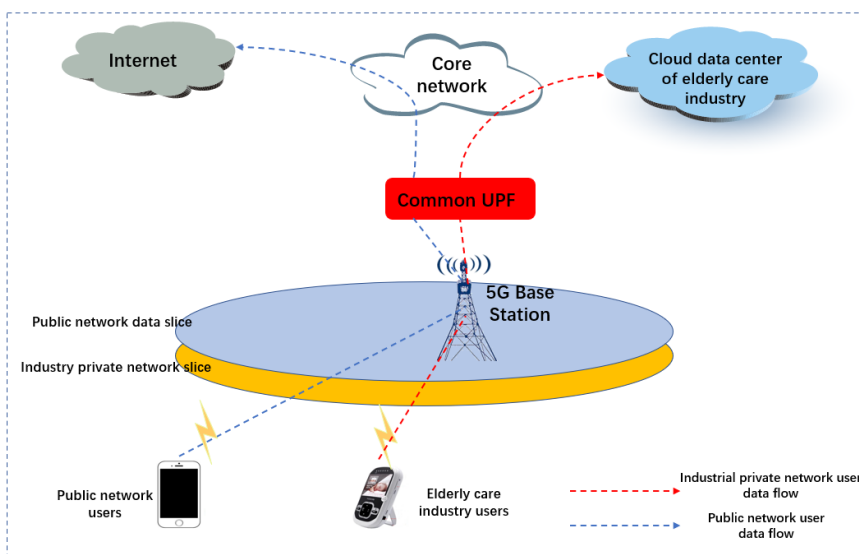


Fig. 4 5G Wireless Private Network Deployment Architecture for Smart Elderly Care

### 3.3 Smart elderly care service platform based on "5G+AI" technology

The smart elderly care service platform of "5G+AI" technology realizes the platform's aging adaptation and informatization transformation by building a smart elderly care service platform, establishes information and data analysis models, deeply integrates the Internet with traditional elderly care services, and explores and practices the new development ecology of home-based elderly care services<sup>[2]</sup>.

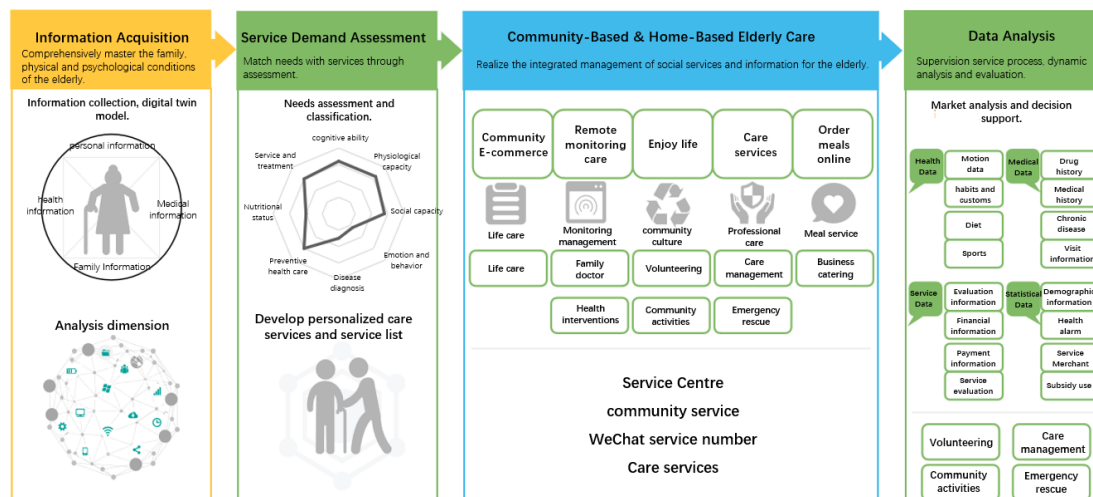


Fig. 5 Smart Elderly Care Service Middle Platform

### 3.4 Business interface of smart elderly care service platform based on "5G+AI" technology

The business interface is an effective way of on-site management. The on-site visual management can greatly improve the service efficiency and reduce the service cost. It is the key link of service standardization and industrialization. The smart elderly care service platform of "5G+AI" technology defines the interface as the on-site visual management mode. The path is: sensor (home side) -- cloud (5G and Internet of Things access) -- interface (visual management and display). The business interface is divided into general interface and sub interface, respectively: service interface (service agency side), patient information interface (doctor, nurse, nurse side), user interface (nurse and family side), and supervision interface (platform supervision and long-term care insurance evaluation side).

(1) The service interface is mainly used for service agency operations, which can respond to residents' appointments and facilitate the service agency to formulate service plans.

(2) Patient information interface is mainly used by doctors, nurses and nurses to view patient information, behavior, physiological parameters and medical report information.

(3) The user interface is mainly used for caregiver operations. The caregivers designated by the caregiver (family members, relatives, friends, service personnel, etc.) can understand the patient's service information and event information, and can also participate by paying service fees, collaborative care, etc.

(4) The supervision interface is mainly used for government platform or third-party evaluation subject operation to supervise and evaluate service effects.

## 4. Technical advantages of smart elderly care service platform based on "5G+AI" technology

### (1) 5G smart elderly care private network

When establishing the smart elderly care service platform, the corresponding 5G smart elderly care wireless private network can be built. Combining the network construction and maintenance costs and construction cycle of different 5G wireless private networks, the "5G+AI" technology smart elderly care service system is recommended to use the virtual 5G wireless private network or hybrid 5G wireless private network mode. In these two modes, the 5G wireless specialty is based on the existing PLMN public network of the operator, and uses soft isolation, slicing and other methods to build/lease a private network for industry users. Only some network elements use dedicated resources (such as UPF, core network control plane, etc.). The cost of building and deploying the entire wireless private network is relatively low. The frequency band and related equipment are mature. It is convenient for data to access the internal network of other regions from the park. The operator is

responsible for later maintenance, It is applicable to the wide area private network business scenario of smart elderly care [3].

The smart elderly care service platform of "5G+AI" technology can adopt the slicing technology of 5G wireless private network. According to the different business needs of the core platform, the virtual network for specific businesses can be flexibly customized, which realizes the agile online business and further saves the deployment cost.

#### (2) 5G+MEC edge computing realizes security and privacy protection

Privacy protection is very important in the "5G+AI" technology smart elderly care service platform system, especially the camera sensor will record a large number of personal activity details, which is most likely to touch people's personal privacy. Use the 5G+MEC edge computing system to ensure that video and other data are stored locally and processed, and not uploaded to the cloud for the time being. After deleting the privacy attribute, these data will be delivered to the cloud server, Realize data security and privacy protection.

#### (3) Match Man Sensor Technology

Match man smart behavior recognition sensor can run a variety of depth learning algorithms in the sensor, including face recognition, action recognition, scene segmentation, etc. When abnormal behaviors are detected (such as the elderly falling, waving for help, leaving a safe area, violence, fire alarm), they can automatically alarm their families or medical staff's mobile apps through the ECS, so that they can be handled in a timely manner. To protect privacy, the alarm signal only includes the skeleton animation of the human body, not the original image and video, so it can be used safely even in the bedroom and bathroom.

#### (4) Smart Senseless Technology Narrows the Digital Divide

Revolutionary home-based elderly care products do not require the elderly to remember any cumbersome operations. Artificial intelligence senseless judgment falls for help and other behaviors to prevent accidents. Smart statistical health activity data alerts the elderly who have not been active for a long time. Only the animation of the human skeleton is displayed to protect privacy 100%, to achieve full coverage of all kinds of home scenes, and to ensure safety all day long.

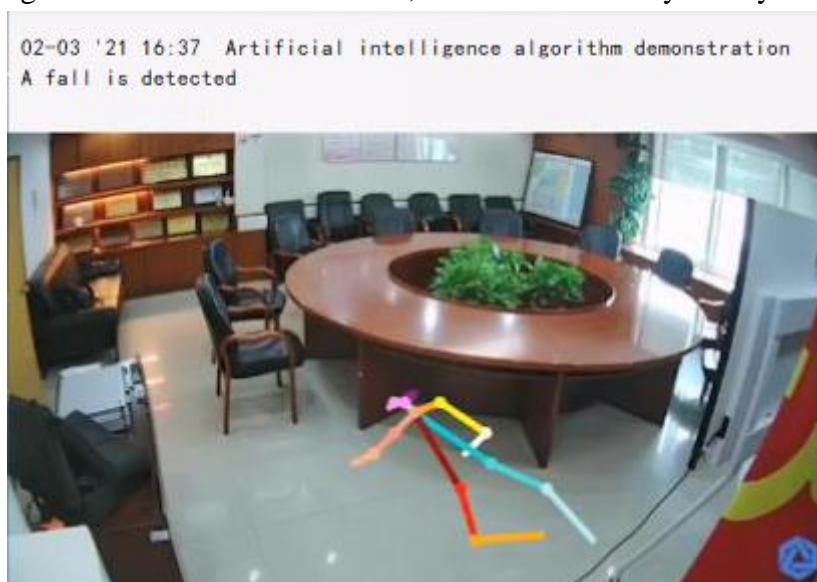


Fig. 6 Artificial Intelligence Algorithm Demonstration

#### (5) AI big data automatically generates risk area thermodynamic diagram

Through artificial intelligence and big data, the thermal map of risk area is automatically generated to prevent falls and provide data support for the aging transformation of the home. Through AI big data, the user activity track thermodynamic diagram is automatically generated to judge the location where users stay most often, providing data support for various abnormal judgments such as mental illness and user health services [4].

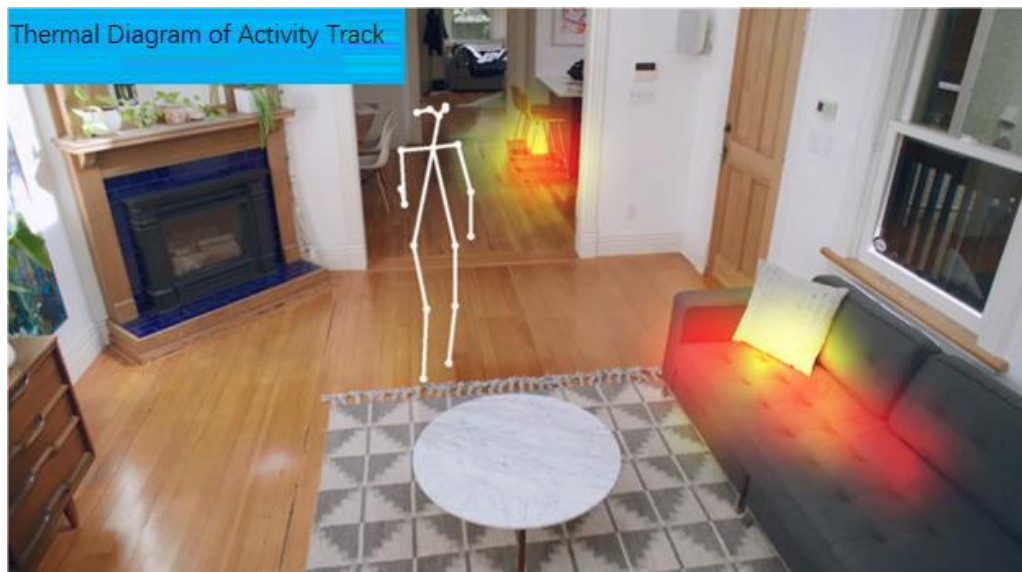


Fig.7 Thermal Diagram of Activity Track

## 5. Summary

With the rapid development of the overall layout of China's 5G network, the digital health service market will continue to expand, and more emerging cutting-edge technologies and advanced models will emerge. How to improve the universality of the smart elderly care service platform system of "5G+AI" technology, so as to achieve the seamless integration and deep embedding of multiple technologies, thus driving the elderly care service efficiency to further improve and generate greater practical value is the next key research direction of the smart elderly care industry.

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