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On the Physical Function Evaluation, Prevention Training, and Cognitive Ability Improvement through the Design of a Healthcare Independence Support System based on Emotional Satisfaction of Senior Users

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Abstract

Recently, social technologies have been created to solve problems from businesses for the establishment of generational solidarity ecosystem in terms of employment, residential space, network and social capital, age, cognitive and environmental aspects. This is senior-friendly healthcare business system aimed at meeting the senior needs for health life to enjoy active consumption culture life even after retirement, becoming a catalyst for minimizing generational conflicts, preventing the cognitive and physical deterioration of seniority in the areas of life healthcare, fitness and well-aging, and expanding into systems necessary for seniority self-reliance. We would like to draw up the development and requirements of the concept of the service platform for the study of collective characteristics for generation solidarity with senior class and the establishment of a customized senior health life system for generation solidarity. This system is characterized by a platform that can prevent the decline of seniors' cognitive and physical functions and enhance emotional stability. It is significant in providing feedback on the risk perception index, fall index, and prevention training index information to the child through the analysis and extraction of the senior health index for risk perception, fall probability, and fall prevention.

Keywords: *Active senior healthy life system, Intergenerational solidarity, Healthcare independence support system, Senior independent living infrastructure, Senior-friendly platform, Wellness platform, Well-aging platform, Physical function evaluation, Prevention training, and cognitive ability.*

1. Introduction

Currently, changes in the population structure such as low fertility and aging are occurring worldwide. As a side effect of change, conflict between generations, such as conflict of values and goals, and distribution of resources such as jobs and welfare support, are occurring. This is expanding into conflict between generations and groups [1]. Seniors aged 50 to under 100 are exposed to threats such as retirement before retirement, pension vacancy, startup failure, illness, divorce at dusk and death of a spouse. In addition, due to competition for jobs with the younger generation, disconnection in values and culture, social discrimination and exclusion, we are facing diseases and loneliness in poverty [2].

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Recently, social technologies to solve problems are being created from business to build a generational solidarity ecosystem in terms of employment, residential space, network and social capital, and age-aware and environmental aspects. This is categorized as an activity that satisfies the desire for a healthy life of seniors to enjoy active consumption culture after retirement. In addition, the senior-friendly healthcare business system is a facilitator that minimizes conflict between generations. This technology is being expanded to a system necessary for seniors' independence in the areas of health care, fitness, and well-aging, preventing cognitive and physical deterioration of seniors, enhancing emotional stability [3]. This paper is based on intergenerational solidarity business for generational solidarity with seniors. In addition, we propose an independent lifestyle based active senior customized health life system that can minimize the conflict between generations in the study of group characteristics and in the general area of life. In consideration of the business-level effectiveness and expandability of this system, it includes a part that derives the senior physical health index such as fall prevention derived from the intergenerational solidarity business. In order to increase the emotional bond between children and seniors, a system for purchasing customized products for seniors identified based on the physical health index, and a conceptual diagram of a platform linked to the senior healthcare service part and designed requirements are also presented.

2. Intergenerational Solidarity Requirements

2.1 Analysis of Solidarity Policy Ecosystem among Active Senior Generations

Population shock caused by aging is changing the population structure. The young generation and the senior generation are creating new conflicts between different generation groups due to socio-cultural gaps and conflicts within the specific generation [4]. The causes of conflict include conflict between values and goals (the burden of medical expenses, etc.), distribution of scarce resources (job, welfare, support, etc.), disconnection from values and culture, and social discrimination and exclusion. Seniors' aging environment is threatened by retirement before retirement, pension vacancy, startup failure, illness, divorce at dusk, and death of a spouse. In order to overcome this laws and systems were established to promote senior life such as health living support center, comprehensive home center pilot project long-term care home service, safe care housing pilot project, local care service, national dementia responsibility system and local community. However, its effectiveness is inadequate [5].

Seniors need infrastructure to support entrepreneurship and reemployment, financial technology, pension management, inheritance and gift, health and family member retention. This should be developed into an infrastructure to support independent living that can minimize the economic conflict between generations in terms of disease, loneliness, jobs and welfare, and burden of support in poverty. The development of this infrastructure is seen as an increase in Seniors need infrastructure to support entrepreneurship and reemployment, financial technology, pension management, inheritance and gift, health and family member retention [6]. This should be developed into an infrastructure to support independent living that can minimize the economic conflict between generations in terms of disease, loneliness, jobs and welfare, and burden of support in poverty [7]. This leads to life projects that provide employment and residential space, life cycles of network and social capital, generation inequality and age-aware environments. This is called intergenerational solidarity. In order to realize a way of life for a sustainable society, Korea is developing a study on age integration through the Korean SSK (Social Science Korea) project. The purpose of this study is to establish a new principle of social construction in response to multifaceted problems arising from aging population and social change. In general, intergenerational solidarity refers to ties between individuals within a family network at a minimum, and between cohorts of different ages in a larger community. In addition, it serves as a point of contact for generational connection, such as increasing intergenerational touch activities that complement each other by sharing space in the form of intergenerational cooperation, intergenerational cohabitation, and intergenerational solidarity [8].

The intergenerational solidarity business starts with an active senior over 50 years of age who shows a desire for an active and autonomous healthy life, rather than the existing seniors who depend on their children's generation to prepare for their retirement life. This is applied as a key requirement for the new concept of

senior healthcare and the aged-friendly market [9]. The area of senior healthcare, which is changing around active seniors, aims to promote comprehensive health in terms of physical, emotional, social, intellectual, and mental aspects such as seniors' mindset, physical fitness, and lifestyle. It also includes a range of health demanders who directly manage their own health based on a wellness model with an expanded concept.

2.2 Senior Healthcare Ecosystem Analysis

The Low Fertility Aging Social Committee predicts that the ratio of the senior population to the total population surveyed from 2011 is 15.5%, and is expected to increase to 21.8% in 2020 and 69.4% in 2050 [9]. Compared to other age groups, the prevalence of heart disease including ventricular arrhythmia, cerebrovascular disease including cerebral infarction, dementia, etc., is increasing in the senior class, which is divided into health service and medical service vulnerable class. As a result, a national senior healthcare ecosystem is being created, such as monitoring technology and rehabilitation monitoring for the health of seniors [10]. In addition, with the growing interest in health among seniors, the doctor-patient relationship is slowly being redefined from a new type of active senior consumer who is ready to use health portals, medical web pages, and emails [11]. The Senior health ecosystem is re-defining and preparing various types of health care elements and platforms that help to improve awareness of new consumer needs and realize the benefits of E-Health based platforms [12]. Because of internet access to mobile devices such as smartphones becomes possible, the healthcare area that manages health using PHR(Personal Health Records) is being converted into a mobile healthcare service for seniors [13]. On the other hand, with the rapid aging, the mobile senior-only healthcare service market is expanding, with seniors as consumers [14]. Various senior only mobile healthcare services are being converted into health promotion, healthcare modules and services that consider the usability and convenience of seniors. It is changing into a platform-based business model, using a universal design medium that reflects motivation, cognitive and psychological states, and emotions for health management [15].

Active seniors show an active attitude toward the use of wearable equipment that can be attached to the human body to easily check health status through blood pressure measurement and exercise volume measurement. They pursue “Bravo Lifestyle” that strives for the purpose of life in old age through steady healthcare [15]. In accordance with the requirements to lead an active and autonomous retirement life, the launch of health care products and services in areas such as food, health checkup, and sports is becoming more active. Senior health management service with smart healthcare background technology applied, fitness for active health promotion, physical fitness improvement, rehabilitation management service, design interface based on senior's experiential value and SNS(Social Network Service) reflecting the design. It is expanded to the field of well aging to be pursued. As shown in Figure 1, it can also be confirmed that it is actively released in various industrial domains due to the convergence of future fusion medical technology and information and communication technology at the public and private level [15].

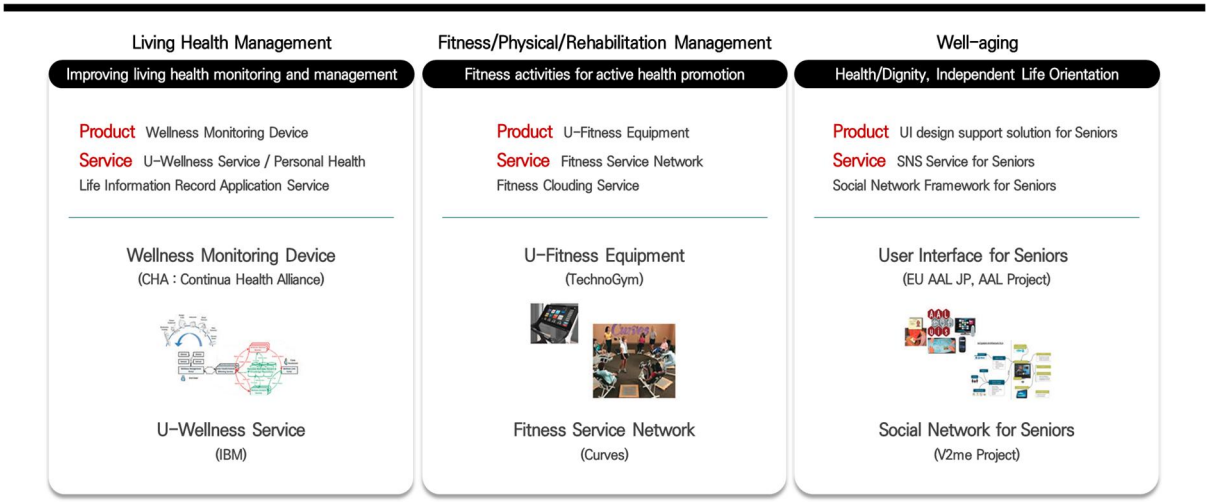

Figure 1. Active Senior Healthy Life Model Research Trends

As shown in Figure 2, each field is being applied to the whole area of life by researching group characteristics for generational solidarity with seniors and increasing needs for expansion of related systems. Senior friendly, which emphasizes design, products and services from an ergonomic point of view to relieve the inconvenience of seniors, not just for the elderly, wellness, including a healthcare business that responds to the needs of senior healthcare, active leisure examples are Fun. which is classified as an entertainment business area for seniors who enjoy cultural consumption, and total management areas such as finance and daily life, which focus on improving the quality of life of seniors [16].

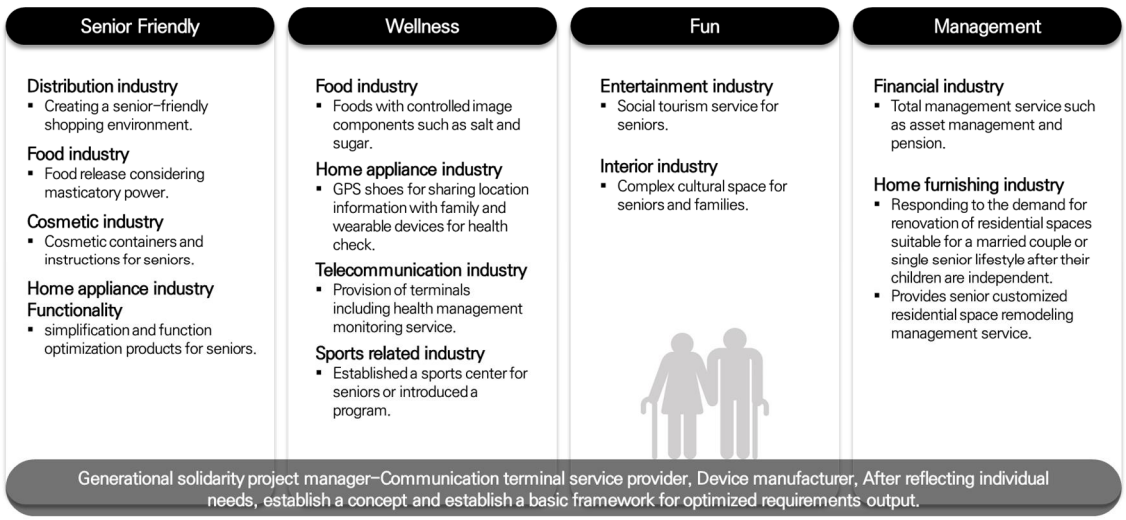

Figure 2. Active Senior Healthy Life Model's Domain Requirements

For intergenerational solidarity with the senior class, it is important to prioritize maintaining the healthy life of the senior. However, various infrastructures for health management of seniors who are exposed to senile diseases are limited to technical infrastructures for coping skills after disease onset such as diagnosis, treatment, and care based on medical, clinical, and pathological findings. Therefore, it is difficult to reflect the requirements for solidarity of various senior generations. In particular, economic burdens such as medical expenses related to senior healthcare in the medical service sector, not the private sector, are amplifying the

conflict between generations [16].

Senior data system for collecting, analyzing, and managing PHR on senior health should be established in order to reduce the fundamental medical costs of seniors that amplify the conflict between generations. Therefore, the infrastructure for supporting independent living, including data collection, analysis, and management system construction in a safe living environment and safe daily life for seniors, should be established. This system's comprehensive wellness model that applies ICT(Information and Communications Technologies) such as App, Web, and Portable Device as well as physical, mental, social, and environmental requirements, in addition to medical modules mainly used by modern health requester is used. It also includes the process of deriving the requirements for a self-reliance support model for falls, a risk factor that can occur frequently in seniors' daily life. In addition, a conceptual design of an infrastructure for supporting independent living based on the active senior healthy life system, which constitutes a generational solidarity through feedback between children and seniors was also conducted [16].

3. Active Senior Healthy Life System based on Independent Living Support Infrastructure's Requirements

Senior healthcare service is not limited by time and place and a healthcare-based technology that continuously monitors the user's real-time health status to detect abnormal signs of health early and recognizes emergency situations such as falls in real time. Also, it is necessary to research sensor network technology to support health management and independent living by installing smart sensors in seniors' homes. Compared to advanced countries such as the USA which widely allow the collection of personal information for human health, in Korea, it is difficult to collect useful data on the cognitive function, independent living and physical health information of seniors due to regulations. Therefore, active senior healthy life system based on independent living support infrastructure, a total of five requirements including personnel lifestyle, wellbeing lifestyle curation, platform service, and chronic disease index analysis should be applied is shown in Table 1.

Table 1. Senior Healthcare System Requirements

Type	Description
Personal Lifestyle	Personnel lifestyle refers to the importance of personal lifestyle. 70% of medical care diseases are caused by lifestyle (eating habits, exercise, stress), and a research result that 80% of chronic diseases can be prevented by lifestyle care has emerged as an important issue.
Wellbeing Lifestyle Curation	Wellbeing lifestyle curation refers to the basic technology of universal design such as UX/UI to improve the experiential value of wellbeing life for health promotion. The service design (psychological service) includes experiential influence factors such as motivating users to reach a desired target point or stimulating desire by sensing and extracting user data to analyze psychology and propensity.
Platform Service	Platform service refers to the provision of platform-based mobile healthcare services based on so-called PaaS(Platform as a Service) and SaaS(Software as a Service). This service refers to providing remote counseling by connecting with a medical institution based on a device-based mobile health platform such as a blood pressure

	monitor, blood glucose meter, and activity meter, and providing measured medical information to a cloud storage. Cloud storage provides inquiry information to medical institutions. For the extraction of personal big data, customized platform services based on artificial intelligence inference functions such as unit behavioral factor extraction and cognitive psychological factor extraction may also be included.
Chronic Disease Index Analysis	Chronic disease index analysis refers to the provision of healthcare services based on objective physical information through index analysis of seniors' chronic diseases and metabolic diseases. First, personal information is input, and the data analysis algorithm analyzes height, blood pressure, electrocardiogram, disease, family history, etc. Chronic Disease Index Analysis can be said to be a new concept service in which the field of emergency medical service research has expanded to the field of personal health care.

Active healthy life system based on independent living support infrastructure. It is necessary to display and monitor information about users and information giving feedback to children. A medium such as web or mobile application is used, and what is needed at this time is a universal design called a general design that considers seniors. Universal design is people who use products, facilities, and services are not restricted by gender, age, disability, language, etc. Therefore, it is divided into system requirements that must be applied indispensably for the senior class with reduced physical ability. Include universal design is Equitable use, Flexibility in use, Simple and intuitive use, Perceptible information, Tolerance for error, Low physical effort, Size and space for approach and in use seven design requirements.

4. Active Senior Healthy Life System Design based on Independent Living Support Infrastructure

4.1 System Overview

On the active senior healthy life system design based on the independent living support infrastructure presented platform service for the concept design of a generational business system based on user emotion satisfaction reflecting the platform requirements presented in Section 3 [17]. This system aims to enhance the emotional bond between families by implementing and providing a senior-child feedback system online. As shown in Figure 3 is a platform system that delivers the execution details and valid data of items performed by seniors to children through the online family space, the House Department. This system includes a feedback system between children client and senior client, where children provide items or purchase products through the store and deliver them to seniors, which is connect to management server.

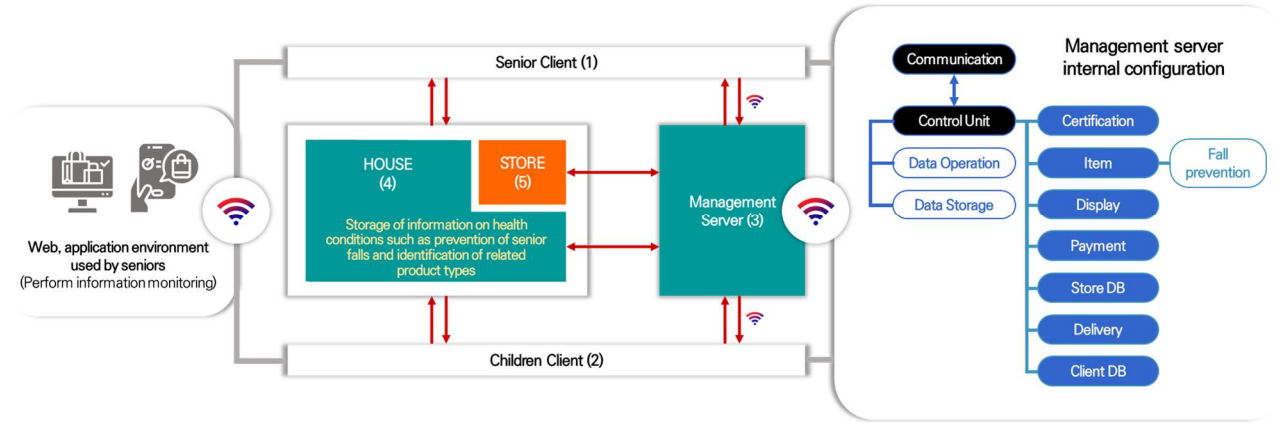

Figure 3. Active Senior Healthy Life System based on Independent Living Support Infrastructure

For system design, the senior's physical function or cognitive function index is provided to the child. In addition, a new business model for selling products for children to purchase products necessary for seniors is included, and is designed using the senior's objective physical or cognitive ability. By purchasing products that are necessary for seniors based on the senior's physical function or cognitive function index, a continuous relationship between seniors and children can be established, and the reliability and satisfaction of purchasing products can also be improved. In particular, senior clients is used to type analysis and data collection on health information such as fall prevention. Children clients is used to provides senior's physical function or cognitive function index to children and a medium through which children purchase products necessary for seniors and deliver them to seniors.

4.2 System Configuration and Design

On the conceptual design in terms of the overall platform and infrastructure was conducted. As shown in Figure 3, this system consists of a senior client, a child client, a house part, a store part, and a management server. First of all, the senior client is a part that collects data and analyzes the type of health information such as fall prevention, and is linked with the children client. The children client provides the senior's physical function or cognitive function index to the child, and the senior client monitors the information in the web and mobile application environment used by the senior as a medium for delivering the product necessary for the senior to the senior after the child purchases it [18]. Perform with the house unit, which stores information on health conditions such as prevention of senior falls and identifies related product types, and the store unit for purchasing the product, are configured to operate within the same platform [19].

As shown in Figure 4, the senior client, children client, house department, and store department are all linked to the management server of the active senior health life system based on independent living support infrastructure. The management server consists of a communication unit for transmitting and receiving information with each part, and a data control unit for calculating and storing information. The control unit of the management server is detailed into a store DB unit that stores user authentication, item identification related to fall prevention, product display and payment, and purchase history, and a client DB unit that manages product shipment and customer information. In order to provide a system that can prevent the decline of the cognitive and physical function of the senior and increase emotional stability, analysis of the senior health index for risk recognition, fall possibility, fall prevention and feedback to children with risk awareness index, fall index, and prevention training index information, information required for seniors and children's clients to purchase the product provide the information to the established management server to provide products to support independent living, and consist of a system that manages shipment tracking.

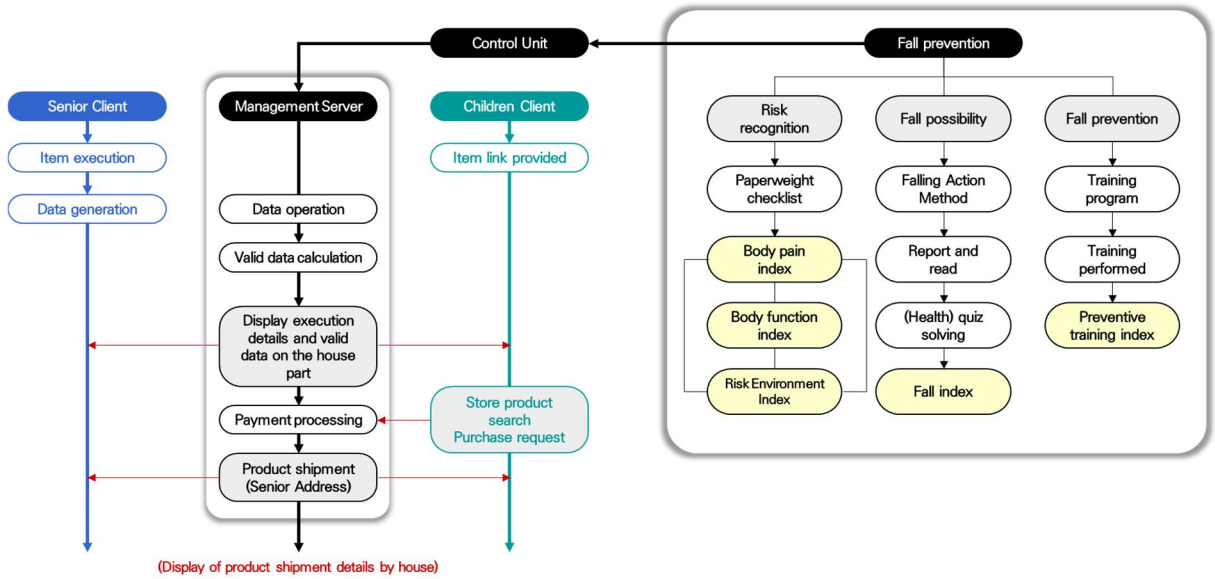

Figure 4. Fall Information based on Senior Product Purchase System

In particular, the control unit of the management server plays a role of extracting an index for fall prevention. In the fall prevention, information on risk recognition, fall possibility, and fall prevention is recognized and marked as an index. First, risk recognition is performed as a checklist for information identification, and body pain index, body function index, and risk environment index are extracted using international standard methodology related to senior risk. In the likelihood of falling, the fall index is extracted by reading data reports on how to cope with falls, and by taking a quiz to measure the corresponding health index. In fall prevention, training is performed based on a training program provided by a hospital or senior center, or a fall prevention program or application separately used, and the prevention training index is extracted.

The extracted five indexes related to fall prevention are linked to the management server, calculates valid data required by the user, displays execution details and valid data on the house unit, and inherits the information to senior clients and children clients. The senior client executes products and service items according to the measured physical health index and generates data on necessary products. Children client provides a link to purchase products and service items for the information, searches for products provided by the store, and requests purchase. When this data flow is finished, the product is sent to the senior address stored in the payment of the item, and the product shipment details are displayed on the house unit to provide information on when the senior receives the product and whether the correct product is being delivered. This system is characterized by a platform that can prevent the decline of seniors' cognitive and physical functions and enhance emotional stability. It is significant in providing feedback on the risk perception index, fall index, and prevention training index information to the child through the analysis and extraction of the senior health index for risk perception, fall probability, and fall prevention. Senior clients who display products that require seniors based on fall prevention analysis information and their children's clients to purchase the products manage the entire process of providing products for independent living and tracking shipments through the management server. This is applied as an element that can minimize the conflict between generations by enhancing the lifecycle in which networks and social capital are formed between seniors and children, and emotional bonds between families.

5. Conclusion

The phenomenon of super-aging of the population causes population shock worldwide. In KOREA, the number of seniors and elderly living alone, accounting for more than 15.5% of the total workforce is increasing. However, this age group is developing into an active senior class who makes meaningful and valuable

consumption for their own hobbies, leisure life, and health promotion based on an independent, active, and stable economic power. In the active senior healthcare sector, investments are currently being made in diagnosis 29.2%, treatment 24.9%, cause identification 23.0%, care 12.8%, prevention 6.1%, and infrastructure 4.0%. In order to support daily life in a wider range of areas, it should be expanded to support programs for independent living necessary in the areas of senior friendly, fun, and total management. Meanwhile new concept called silver suffer, which accounts for 80% of active seniors who have a "BRAVO Lifestyle" lifestyle pattern striving for their old age identity and purpose of life, is applied. Silver people are suffering a new type of active senior who strives for the digital information gap and shows an independent consumption pattern to purchase items such as health promotion that they need. Therefore, it is expected that, starting with the active senior group, various wellness models for independent living are applied, and related value investment activities will continue. We designed active senior healthy life system based on independent living infrastructure in accordance with this trend is equipped with various items for physical function evaluation, preventive training, and cognitive enhancement, thereby preventing the decline of the physical function of the senior and helping to strengthen cognitive function.

The infrastructure for active seniors' independent living and the healthcare model to cope with the infrastructure presented in this research are fragmentary examples for building an infrastructure system for self care, prevention, and senior friendly support for daily life in various areas. It can be expanded to a necessary independent life support program in the area of fun and management, and it is judged that it can be applied as a basic model for all products and services presented in the physical, emotional, social, intellectual, and mental wellness models. In order to provide a platform to prevent cognitive and physical decline in seniors' cognitive and physical function and increase emotional stability, this system analyzes and extracts senior health indexes for risk recognition, fall possibility, and fall prevention. It is meaningful to feedback the index and prevention training index information to the family. In addition based on the comprehensive analysis information, the senior client information related to the product required for the senior and the child client to purchase the product manage the entire process of providing products for independent living and tracking the shipment through the linked management server. There is an advantage in minimizing the conflict between generations by enhancing the lifecycle of the network and social capital between children and the emotional bond between families.

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