A Study of Properties and Services of a Smart Home for the Elderly

Sun Jung Lee, Hyo Chang Kim, Sang Min Ko, and Yong Gu Ji

Department of Information & Industrial Engineering, University of Yonsei, Seoul, 120-749
{sunjung,huychag1,sangminko,yongguji}@yonsei.ac.kr

Abstract. Republic of Korea is expected to enter into a super-aged society. Therefore, the needs of studying improved services and policies which support the quality of life, health, and comfortable living condition of the elderly are likely to increase. This study suggested a research direction of necessary properties and services for a smart home by analyzing existing studies to support the life of the elderly. Through investigation and analysis of studies of smart home and the elderly, we identified problems and implications of current smart home related studies.

Keywords: Smart Home, Smart Home Service, Elderly, Ergonomics.

1 Introduction

According to the standards of UN, a country is considered as a super-aged society if the percentage of population aged over 65 is more than 20 percent. Korean aging population is expected to go over 20% by the end of 2026 and heading towards a super-aging society [7]. With rapid aging of Korean society, a peaceful life for the elderly is becoming more important issue. The elderly people spend most of their time in their home because their range of activity is limited according to their body capability. Therefore, it is an important issue that how much the living space can support the elderlies' independent lives [14]. To support a peaceful life for the elderly, this study focused on studying services and properties of smart home.

Smart home means high quality life supporting technology which connects home appliances together by naturally interacting with humans. Smart home is based on wired/wireless communication and digital information appliance. It provides any time accessible ubiquitous environment using home networking and network accessible home appliances. Therefore, smart home means intelligent living environment aiming for 'intelligent living space, environment friendly life, and recreation of quality of life' [3]. As consuming high quality contents is becoming more common these days and the number of network accessible home appliances is increasing, smart home services are extending its range to home entertainment, home controlling, healthcare and more. Development of IT technology and info-communication increased possibility of supporting studies for smart home based on connected home appliances as well as possibility of supporting living conditions of the elderly using smart home

technologies. More studies about building smart home which fit in the properties and living conditions of the elderly to support the elderly's comfortable living conditions and their actual lives are needed.

2   Related Work

To analyze existing smart home related studies and services 1) we studied actual conditions and trends of existing studies of smart homes related to individual foreign countries and 2) we investigated actual technologies and services of domestic smart homes.

2.1   Trends and Related Work of Smart Home

About 440 thousands of smart homes are estimated to be built around the world, and it is expected to increase to 5,380 thousands of smart homes by the year of 2015 [5]. Since 1991, America is concentrating on developing technologies such as interface technology which connects humans with computers according to "Networking and IT R&D; NITRD". America is interested in developing smart devices which can provide services according to individual user's properties and needs by focusing on developing applications and devices using computing technologies. Japan is running a smart home project cooperated by Toyota Motors Corporation and Toyota city. They have house type for their smart home, and they are planning to apply IT technology to the whole city [6]. Netherlands is trying to expand green home field to minimize the CO2 emission. Unlike other countries, Netherlands is approaching to smart home in the perspective of welfare and they provide many designs for the elderly, the disabled, and the weak [8, 15-16]. Australia is running a government driven business named 'Climate Smart Home', so anyone can volunteer for the project. Most of their smart home field is focused on smart grid [1].

Table 1. Summary of studies related to smart home

Categories		Subject
Technology Centered Studies	Smart Home Concept	A study of smart home standards and suggestion of smart home guidelines [9, 13].
	Application of Smart Home Technology	A study of related technologies which can be applied to smart home related services and system construction of smart home [12, 17].
User Centered Studies	User Analysis	A study of predicting and analyzing behavior patterns of smart home service users [4, 10, 18].
	Usability and Technology Evaluation	A usability test of particular smart home service and technology [2, 11].

In this study, we collected and analyzed studies of smart home as shown in the Table 1. Smart home related studies can be divided into 1) technology centered studies which study smart homes theoretically and studies which construct systems

2) user centered studies which study behavior patterns of smart home users and studies which conduct a usability test of particular smart home services and technologies.

2.2   Trends and Related Technology of Smart Home

Smart homes in Republic of Korea provide home platform technology which allows home networking service, home networking technology which allows access to information appliances by using wired and wireless internet, intelligent information electronic appliance technology which allows convergence information appliances to provide customized service, and green home technology which minimizes emission of CO_2 and energy consumption in residential area (Table 2). We investigated smart home services and technologies in Republic of Korea. Major construction companies in Republic of Korea adopt smart home service in their new apartments. The companies concentrate on smart grid services which can remote control home appliances in home. For example, 80% of smart home in Jeju island in Republic of Korea concentrated on energy saving and smart grid services. Therefore, we could conclude that smart homes in Republic of Korea have many services related to energy.

Table 2. Summary of technologies related to smart home in Republic of Korea

Categories	Explanation	Related Technology
Home Platform	A technology that allows emotional home networking services based on external network and home convergence contents	• Home server / Gateway • Apartment complex server linkage • Home device architecture
Home Networking	A technology that allows access to information appliances by mixing wired internet and wireless internet at any time	• Wired home networking • Wireless home networking • Wired/ Wireless linkage technology
Intelligent Information Electronic Appliance	A technology that allows convergence information appliances to provide customized services by recognizing its surrounding using sensors	• Information appliances • Home sensors • Realistic home theater • UI and interaction technology
Green Home	A technology which minimizes the emission of CO_2 and energy consumption in a residential area	• Green home energy management • Smart grid linkage • Green home environment management

Properties of services and technologies applied to smart homes in Republic of Korea are as follow. Smart home companies in Republic of Korea provide a service which identifies individual resident by their own identification card to secure the

home. The companies also provide a service which allows the residents to remote control their home appliances by their smart devices as well as a service which allows the residents to check their home information and remote control their home appliances by their smart living information appliances. As we can see above, current problem of smart home in Republic of Korea is that their smart home services and technologies are depend too much on construction companies and smart home related companies not on actual residents. Therefore, ergonomic approach to smart home is essential and urgent in Republic of Korea.

3   Issues on Smart Home for the Elderly

Other countries with the better growth in smart home field than Republic of Korea are studying to develop various smart home service models considering their residence characteristics and the elderly. However, there are lack of studies about residence characteristics and the elderly in Republic of Korea, and those studies are limited to technical realization and service presentation. Furthermore, the construction companies strongly depend on other countries' cases when they develop new smart home services. When comparing to other countries' study cases, smart home studies for the elderly are insufficient in Republic of Korea. The elderly people spend most of their time in their home and have limited body capability. Therefore, future studies should focus on smart home studies that can support the elderly living in Republic of Korea that have physical limitations, cognitive ability limitations, and low technology acceptance. Indigenous smart home in the Republic of Korea should be studied considering cultural differences and living properties of the elderly.

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