

The New Way of Social Connecting for the Elderly Through Smart Home Applications

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Abstract. An emerging elder-living centric concept has brought a new category of potential business opportunities into the needs of aging and aged societies. This emerging concept is nourished by the diverse applications of information and communication technologies; Smart Home is one of the killer applications integrating the technologies of the Internet-of-Things and the Social Network to facilitate a better elder-living and to maintain the family values and traditions. This article identifies the needs of various types of the elderly and elaborated what applications can facilitate the elder-living, and thus a new concept of Smart Home is positioned.

Keywords: Social media · Smart home · Open innovation model · Service science · Strategic planning

1 The Aged Society Is Coming

The aging and aged societies, according to the definitions from the WHO (World Health Organization), the population proportion of the aged over 65 exceeds 7 % is classified as the “aging society” and classified as the “aged society” if the proportion exceeds 14 %, have been more and more common in the globe. There are two major reasons behind this, one is the fertility rate is declined and reaches a stable level, at the meantime the other is the life expectancy is increasing. This aging trend will impose major social and economic consequences against the societies from various perspectives (Department of Economic and Social Affairs Population Division 2013). Taiwan is inevitably moving toward an aged society rapidly and will be a hyper-aged society—20 % of the population will be the age over 65 years old—by 2025, predicted by the *Council for Economic Planning and Development* of Taiwan. However, this paper argues that many elderly are not disable and can still lively pursue their meaningful lives such as taking care of the youngsters of the family, maintaining their social connections, doing the physical-appropriate jobs, learning new skills, or exploring the philosophic spiritual world.

Based on the Employment Analytic Data prepared by *Taiwan National Statistics* from the year 1993 to 2013, this paper has found that the workforce of age over 45 is increasing from 23.88 % to 37.27 % with 2.25 % year-to-year growth illustrated in Fig. 1; and furthermore, the workforce of age between 50 and 64 contributes more

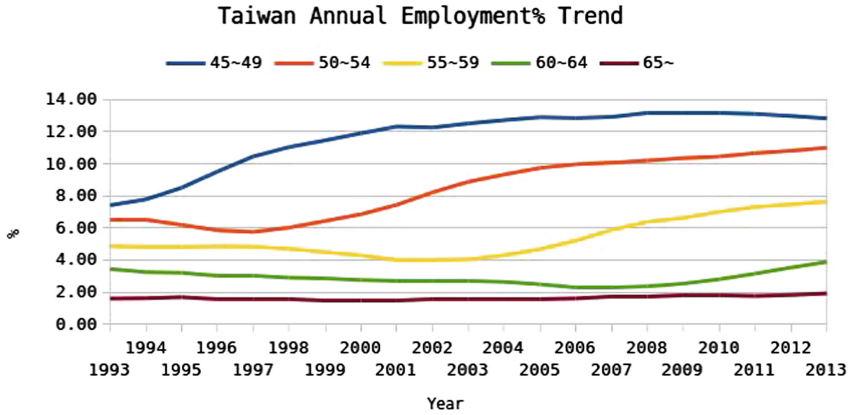


Fig. 1. Taiwan annual employment rate trend

growth of the proportion illustrated in Fig. 2. This implies that the age of retirement is delayed and should be a strong employment market demand for the senior workforce in Taiwan (Directorate General of Budget 2014). In this senior population, a concern of Digital Divide—the gap between the underprivileged members of society, who do not have the access, or reluctantly approach, the computers or the internet—will restrict the capability of seniors from taking advantage of technologies and information to interact with the innovating world as the new generation do.

According to the report of *World Knowledge Competitiveness Index 2008*, Taiwan was top ranked the 6th of broadband access and the 9th of Internet hosts, per thousand users (Centre for International Competitiveness 2008). This implies that the population of using the Internet is considerably high; the digital divide is on the way of closing the gap at least in the metropolitans of Taiwan. On the other hand, the population of higher

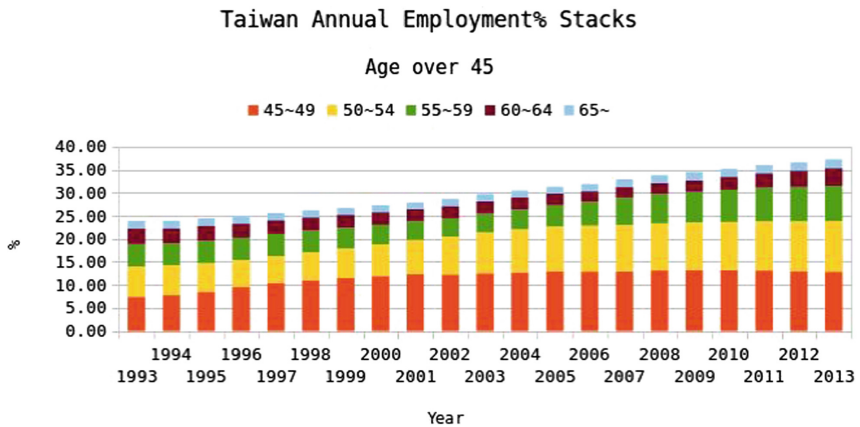


Fig. 2. Taiwan annual employment rate stacks

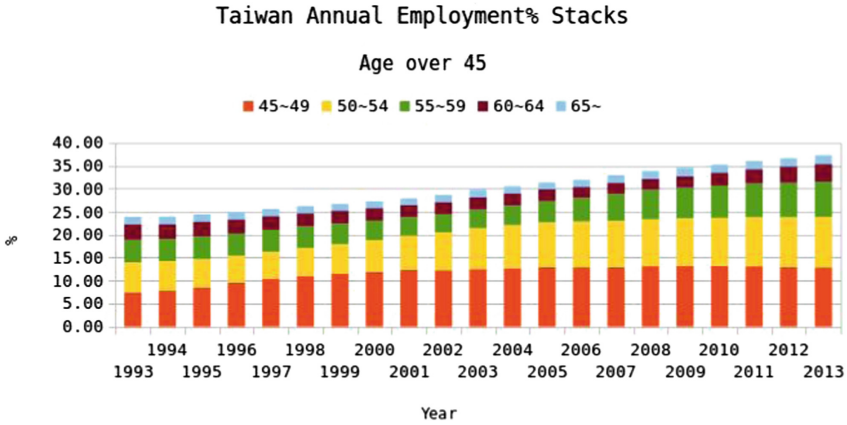


Fig. 3. Taiwan annual employment rate stacks

education (above the college graduated) is annually increasing illustrated in Fig. 3; another interesting finding is that more elderly of Taiwan are using the mobile devices and the apps to reach out their connections. This means that the aging and aged people should be more capable to apply the new services brought by the information and communication technologies to facilitate their works and living than before (Directorate General of Budget 2014) (Fig. 4).

In the Confucius world such as Taiwan or China, a society that is honoring and paying the respect to the family value—taking care of the youngsters and look after the elderly (Zhengkun 2012), most of these family structures can be understood from various perspectives: (1) having/no children, (2) having/no elders or disabled, (3) single parent/both parents, (4) living with/without children, (5) living with/without elders or disabled, (6) single/both income, (7) leased/own premises, or (8) living in city/rural; the family types can have up to 2^8 combinations. It is almost impossible to design or

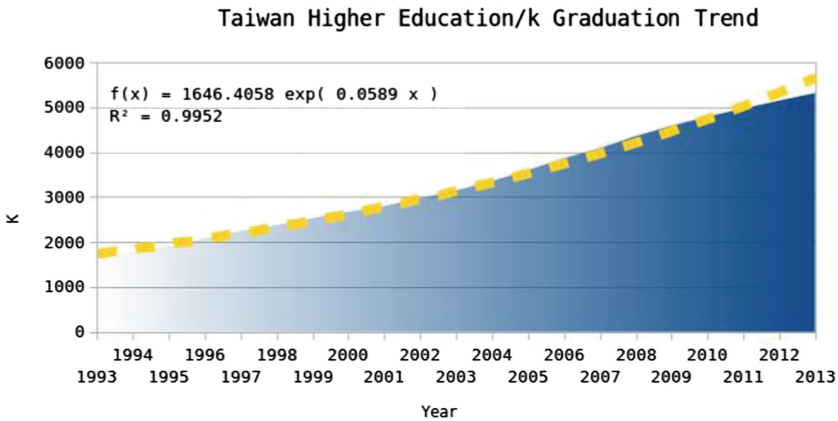


Fig. 4. Taiwan higher education/k graduation trend

explore the requirements of specific services without aiming the target family structure first. On the other hand, there are core values centered in the Confucius families; therefore, despite of the numerous structure combinations, exploring the needs from any particular structure will result the similar essence of family needs. Observing from such a social reality, among these family structures, this paper argues that, it is very common that the elders, usually the grand-parents assist in taking care of children and doing the miscellaneous chores for the family; the adults always care about the elderly and their youngsters when they are out for working.

Based on the aforementioned viewpoints—the aging and aged less-digital-divided-population trend, the increasing educated people, and the ubiquitous computing environment—this paper argues that the technologies related to maintaining the family value can fulfill the social needs of nowadays families from the perspective of the elderly.

2 Smart Home Versus Digital House

The definition of Smart Home is still under developing; it is very vague between the differences of the terms of Smart Home and Digital House. These terms are used alternatively in various occasions. There is a common definition about the smart home or smart house that incorporates advanced automation systems to provide the inhabitants with sophisticated monitoring and control over the building's functions (Smart Home Energy 2014). This paper looked up the abstracts of the first 50 of the 170 published articles collecting total 73,691 words in 2014 from Google Scholar by using the keywords of “Smart Home” and “Elderly” surveyed on 21st, Dec., 2014. Most frequent words occurred in these abstracts were about the concepts of: (1) video, sensors, tool, robot, technologies; (2) patients, adults, citizens, persons, users, people; (3) products, design, development; (4) falls, assistive, prevention, health, medical, care, environment; (5) settings, activities, detection, monitoring, living; (6) need, requirements, project, platform, system; (7) process, service, industry; and (8) issues, challenges, social. It is worth noted that the term of *Gerontechnology*—an interdisciplinary field of scientific research in which technology is directed towards the aspirations and opportunities for the older persons and aiming at good health, full social participation and independent living, development or design of products and services to increase the quality of life for the elderly (Bouma 2014)—plays significant role in the concept of Smart Home. The *Tag Cloud*—a visual representation of context driven tags or keywords based on their occurrences—illustrated in Fig. 3 explains the most frequently addressed words among these abstracts.

It is obvious that the meaning of “home” and “house” should be with two different concepts; the “house” refers to a premises or a building while the “home” is more toward spiritual belongingness. This paper argues that the concept between the Smart Home and the Digital House is a different idea. The Digital House applies the technologies to automate the command-and-control activities to provide a more convenient living and accommodated environment to the people; while the Smart Home is not just about automation but more toward human-centric concept that connects to people and brings meaningful social values to the family (Fig. 5).



Fig. 5. The tag cloud of Smart Home for the elderly

3 Lifestyle and Daily Activities of the Elderly

In order to design the potential required services of Smart Home to the elderly, this paper identified two metropolitan but with different aspects about lifestyle as the sample, Taipei and Kaohsiung, to conduct a series of interviews to understand whether the elderly would accept and be willing to adopt the concept of Smart Home to retain their family value by taking advantage of technologies. These interviews collected the information of family structure from the interviewees and inquired them about what the common daily activities are. The interviewers chose the elderly, one hundred samples of each metropolitan, from the city parks, the elderly communities, and the apartment builders.

This paper prepared a structure questionnaire in the Mind-map form as the basis for the interviewers. The survey team used the mobile pad-device and a shared folder over the Internet to facilitate the interview. The interviewer denoted the competence score from 1 to 5 for each links between nodes and could also develop a customized questionnaire from the basis to collect the unplanned information. For example, “Do you wish to have the parents to watch the children home activities remotely?” the interviewer recorded the proper score on the link between the nodes “Children” and “Remote Care” on mind-map questionnaire, based on the confidence of the interviewee’s answer. Each interviewee had his/her own questionnaire file stored on the shared folder. This paper consolidated all questionnaire files, derived a superset mind-map to cover various aspects, and aggregated the scores between nodes to imply the degree of need about the concept represented by the nodes respectively (Fig. 6).

The questionnaire consisted of four concepts namely: (1) Digital Devices—to understand the degree of digital product manageability of the interviewee; (2) Living—



Fig. 6. The elderly lifestyle and daily activities

to understand the degree of adoptability of the digital house appliances; (3) Care—to understand how the interviewee manage his/her health related activities; and (4) Actualization—to understand the need of learning and employment. The interviewer introduced the potential Smart Home services during the survey; for example, when asking the attitude about “Remote Care” under “Health”, the interviewer explained the features of video surveillance and how they can be used to re-exam the reasons causing the elderly falls; when asking whether the interviewee uses popular instant messenger such as LINE or Hangout to chat with their friends, the interviewer explained how these features could help in extending the social connections. Therefore, the training of the interviewer took quite some time and practiced what was the better way of eliciting the information from strangers in the field. Some of the elderly were very protective and not willing to share their daily activities.

4 Findings and Implications

Based on the analysis of the aforementioned questionnaires, this paper posits that there will be a strong demand of Smart Home services for the elderly. First watching the television is still a part of the daily family life; the television has been in the focus of the living room since it was brought into the families as one of the information delivery channels. The Smart TV—enables the audience to use apps and browse the Internet directly on the television—embraces the traditional programs from the stations and the rich content from the Internet through applications to extend the boundaries of information. Recently, as the emerging development of mobile and cloud computing, the Smart TV can share the content with the friends of the family social network and collaborate the tasks with the family partners such as supermarkets, school teachers, and health care centers. Therefore, this article extends the concept of the Smart TV and continuously positions it as the focus of the family and the channel of value exchange.

There are four categories of the elder-centric activities: (1) **Family**—shares family responsibilities and helps family members things or doing the activities for them; (2) **Social**—connects to people and maintains social relationships, such as friends, members of communities, school teachers; (3) **Healthcare**—keeps physical and mental condition healthy including seeing the doctors, replenishing the chronicle prescription or wellness foods; and (4) **Actualization**—learns interesting things and make self usefulness. The Fig. 7 illustrates the aforementioned idea of Smart Home applications for the elderly. Furthermore, this paper identifies the user scenario for the elderly illustrated in Table 1 and depicted as follows:

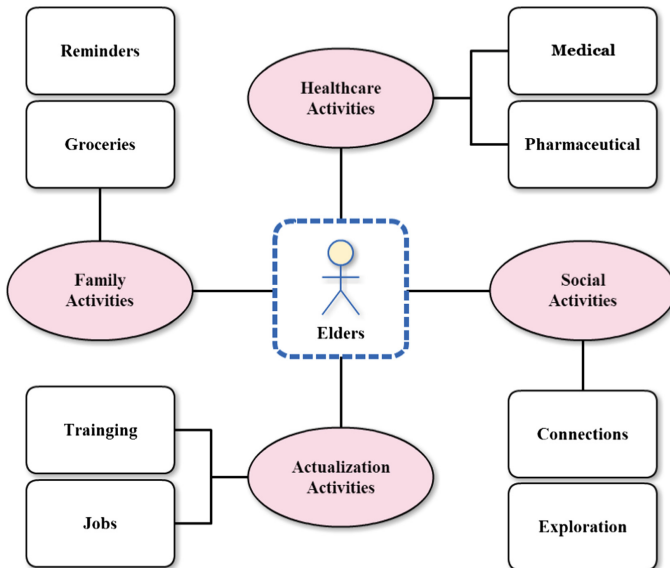


Fig. 7. Smart Home activities of the elderly

Table 1. The user scenario for elderly

Activity	Explanation
Reminders	<ul style="list-style-type: none"> • Check the to-do list of a day.
	<ul style="list-style-type: none"> • This to-do list can be input by the members of the family.
	<ul style="list-style-type: none"> • Environment hazard checks such as from gas, CO₂, and fire.
	<ul style="list-style-type: none"> • Safety monitoring through surveillance cameras at home.
Gathering	<ul style="list-style-type: none"> • Watch the TV news.
	<ul style="list-style-type: none"> • Read the headlines of major newspapers from the Internet, collected by the news delivery predefined application.
	<ul style="list-style-type: none"> • Comment on the interesting topics.
	<ul style="list-style-type: none"> • Initiate a virtual conference, picnic, with the family members not nearby.
Medical	<ul style="list-style-type: none"> • Make a reservation to see the doctor.
	<ul style="list-style-type: none"> • Invite the friends who are also going to the same hospital.
	<ul style="list-style-type: none"> • Check the waiting-list of the reservation.
	<ul style="list-style-type: none"> • Read the patient instructions from the doctor.
	<ul style="list-style-type: none"> • Update family expenditure records.
Pharmaceutical	<ul style="list-style-type: none"> • Order the prescription medicines or the wellness foods.
	<ul style="list-style-type: none"> • Check the waiting-list of the orders.
	<ul style="list-style-type: none"> • Receive the goods from the purchased stores.
	<ul style="list-style-type: none"> • Update family expenditure records.
Grocery	<ul style="list-style-type: none"> • Read the promotion items from the neighbor supermarkets.
	<ul style="list-style-type: none"> • Share the item information with the friends.
	<ul style="list-style-type: none"> • Order the desired items.
	<ul style="list-style-type: none"> • Check the waiting-list of the orders.
	<ul style="list-style-type: none"> • Receive the goods from the purchased stores.
	<ul style="list-style-type: none"> • Update the to-do list if the items were on the reminder.
	<ul style="list-style-type: none"> • Update family expenditure records.
Connections	<ul style="list-style-type: none"> • Read the status updates of friends through the social network application.
	<ul style="list-style-type: none"> • Chat with the friends about the interests.
	<ul style="list-style-type: none"> • Join the virtual organizations and share thoughts.
Exploration	<ul style="list-style-type: none"> • Enjoy the sightseeing, update the status and upload photos throughout the journey for the sharing.
	<ul style="list-style-type: none"> • Read the promotion from various exhibitions and the travel agents.
	<ul style="list-style-type: none"> • Share the information and hear the comments from the friends.
	<ul style="list-style-type: none"> • Make a reservation and travel plan.
	<ul style="list-style-type: none"> • Check the travel status and the weather condition.
	<ul style="list-style-type: none"> • Update family expenditure records.
Training	<ul style="list-style-type: none"> • Participate in the spiritual or philosophic gatherings, the trainings for new skills of interests.
	<ul style="list-style-type: none"> • Initiate a virtual classroom to make contribution to the society.
	<ul style="list-style-type: none"> • Share the knowledge and experience to virtual attendees.
Jobs	<ul style="list-style-type: none"> • Seek the appropriate jobs for the elderly.
	<ul style="list-style-type: none"> • Check the hiring status from the employment agencies.
	<ul style="list-style-type: none"> • Receive the hiring recommendations from the agencies.

5 Service Realization and Business Potentials

The Smart TV is emerging as an important medium for advertisements to reach out to the target audiences—family members—by grabbing their attention through multi-screens, driving the market growth not just of the Smart TV but also of the applications and the associated content providers business (Wood 2014). This trend implies that more applications running on the Smart TV can get revenue from the associated advertisements, which is similar to the mobile business model for the applications. There are many existing applications for reminders running on the Smart TV and the mobile devices—similar to the “TODO list”—such as the “24me” (Pozin 2014) which is a task-management and able to send-and-receive notes for family and social events. To link the frequently contacting friends or groups of shared interests, it is very common to gather the people using the instant messenger applications such as “Ekiga” providing the video conferencing and text messaging features. The Fig. 8 illustrates the holistic concept of Smart Home applications from the elders’ perspective. Many concepts of Smart Home for the elderly have been already realized by the existing business applications.

The healthcare is one of the major concerns of the elderly; using the sensors to monitor the living safety—such as the surveillance camera can be used for detecting the location of the sound source where the special events occurred (Ou et al. 2013)—and the functional status—such as for fever thermometers, skin sensors, blood analyzers, etc. (GE Sensing 2007)—; using the online hospital reservation application—such as the one offered by the “Taipei Medical University Hospital”—to book the regular health examinations, will significantly alleviate the stress of the caregivers (Tomita et al. 2010). Selling the wellness foods and the prescribed medicines from the online drug stores such as “Drugstore” and “Walgreen” has been a mature business model—retail clinic—for years. The role of these ubiquitous “retail clinic” is expected to exchange of health information among the medical specialists and hospitals to let the

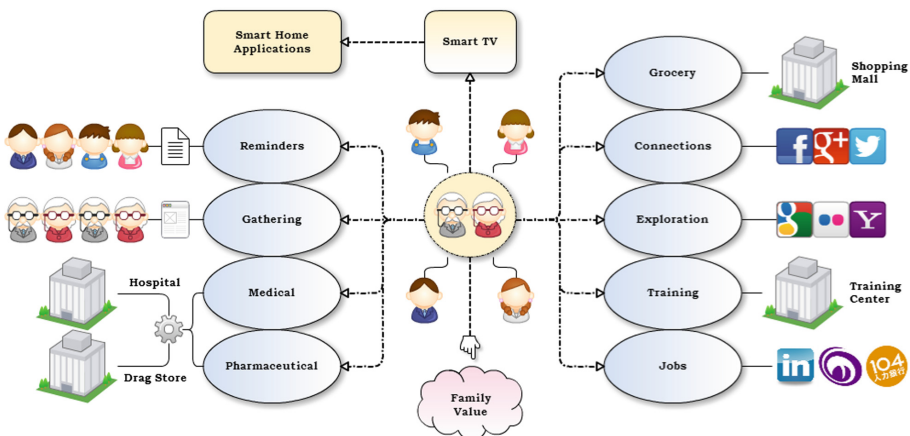


Fig. 8. Potential business opportunities of smart home from the elderly perspective

relevant clinician to access the patient's health information by taking advantage of the convenience brought by the information technologies (Cassel 2012).

Grocery shopping is one of the important daily family activities, has been addressed in many literatures (Hollywood et al. 2013; Nilsson et al. 2015). An interesting finding was that many people at work agreed to the convenience—access, search, evaluation, transaction, possession, and post-purchase (Jiang et al. 2013)—could be brought by the online shopping but not had the enough time to shop online purposely (Noor et al. 2011). This implies that the elderly can take the advantage of the convenience of online grocery shopping with less time constraint.

It is evident that the elderly using the social media tool to connect people and to explore the interests are increasing. The social media is also widely used to promote products and services by the business owners. This hybrid element of the promotion mix gives a new way of communication directly to the customers and the potential influencers through their social network (Mangold and Faulds 2009). The social media can bring much benefit for the elderly such as: (1) keeping in touch with friends, (2) learning new things, (3) asking questions especially the health related, (4) entertaining themselves through multimedia contents and online games, (5) finding jobs, (6) entrepreunering the existing or a new business, and (7) seeking the opportunities of big sales (Ng 2012).

Based on the aforementioned elaboration from the existing applications and the literatures, the potential business cases of Smart Home for the elderly are solid. The technical challenge will be the integration of these applications as the Smart Home service portal for the elderly on a single Smart TV.

6 Conclusion

The Smart Home services base on the top of Digital House to provide environment sensing and appliances control capabilities to offer a new lifestyle for the elderly, not just taking care of themselves but also making contribution to the family, most of all, retaining the family value through the daily activities that bind the family members in more interactive and concerning way by taking advantage of technologies. The aforementioned findings can be served as guidance of the service design in the Smart Home industries. Considering time-to-market, the vendors of Smart Home service industries should apply the Open Innovation Model—to collaborate with other vendors, to share the resources, and bring the tangible services to the market—would be sooner and effective than trying to reinvent-the-wheel or replicate less competitive me-too by oneself.

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