

# R&D Strategy of HCI Technology for Aging

Sangil Kim

Korea Institute of S&T Evaluation and Planning, Korea  
cappy@kistep.re.kr

**Abstract.** The prevention or elimination of causes of death in early life has resulted in a population consisting of an increasing proportion of elderly people. With this increasing proportion of elderly people, we will encounter many problems like a degenerative disease, the depletion of welfare money like public medical insurance and the lowering growth rate of nation, and so on. In this research, at first every possible expected issue related to aging population was drawn through literature review and expert interview. Then products and service need to tackle aging population issues was drawn. The last step is to draw key technologies to realize these products and services. Among such technologies, we studied which technology belongs to the HCI technology, and carried out survey of the impact of each technology economically or socially. Based on these results, we presented a R&D strategy of the Korean government for the HCI technology development in response to the future aging society.

## 1 Introduction

Death rate reduction due to the advancement of modern medicine and improvement of daily healthcare and low birth rate, the Korean society is becoming aging population rapidly. Also, as a low birth rate is evident throughout the world, aging society rapidly proliferate as well all over the world. In particular, China, which has the largest population in the world, is predicted to have more than 400M aging population by 2033. Japan has already entered into an aging society in 1970 when population over 65 year's old exceeded 7% out of total population, and has become a super aging society in 2006 when aging population exceeded 20%. For Korea, proportion of aging population in 2000 exceeded 7.2% and has become the world's fastest aging society since then. The working population in Korea will start to decrease from 2016, and its decreasing rate will be expected to be faster than Europe and Japan. The average age of the population in Korea, currently 37.9 year's old, is already more than that in the USA, and is expected to exceed Europe by 2020. Thus, this study analyzed aging population-related issues, which are expected to be the most significant impact on the Korean society and require urgent action, and studied how the HCI technology can contribute to this issue response. To achieve these objectives, first, problems due to aging society were identified. Then, products and services for solving these problems were identified followed by selecting core technologies required for implementing the identified products and services. Among the selected core technologies, we identified which technology belongs to the HCI, and via the evaluation of each technology, future direction of technology development was presented.

## 2 Identification of the HCI Technologies in Response to Aging Society

### 2.1 Analysis of the Aging Society Related Major Issues

The web search query data of DAUM was utilized for analysis of issues with regard to aging society of population structure. Through this process, major keywords were identified and structured, and then detailed contents per issue were identified via literature reviews and examination of experts on aging society. The detailed issues regarding the identified population structure aging were categorized in terms of health, economy, living, and society.

**Table 1.** Detailed issues regarding the population structure aging

Category	Main issues
Healthy life	Degenerative brain disease increase (Alzheimer, Parkinson's disease) Increase in chronic disease prevalence (Hypertension, Diabetes, and Arthritis) Mental stress increase Physical/Cognitive impairment Increased need for anti-aging and health care
Economic stability	Economic difficulties due to stable income loss Financial insecurity of social welfare due to the increase in the burden of health expenditures Decrease of economic vitality due to reduction of production and consumption population
Safe and convenient living life	Increase in demand on age-friendly information devices Difficulties in voluntary motion (Physical and cognitive ability degraded ) Lacking in voluntary daily living ability
Continuous social relationship	Difficulties in voluntary motion (Physical and cognitive ability degraded ) Conflict between members of family or intergenerational conflict around the elderly Conflict between the elderlies (polarization within the elderly society) Elderly alienation deepened Information gap deepening

### 2.2 Products and Services in Response to the Aging Society Issues

Products and services in response to the previously identified major issues of population structure aging were identified. During the identification process, candidates were limited to products and services which were only implementable by utilizing science and technology. That is, services simply given through policy support were excluded.

**Table 2.** Products and services in response to the aging society issues

Issue	Products and services that can be implementable via science and technology
Degenerative brain disease increase	Early diagnosis system for degenerative brain diseases Medication for degenerative brain diseases Life-care service robot
Increase in chronic disease prevalence	U-health remote healthcare system Life-care service robot
Mental stress increase	Artificial intelligence chat robot
Physical/Cognitive impairment	Rehabilitation robot Artificial intelligence robot
Increased need for anti-aging and health care	U-health remote healthcare system
Economic difficulties due to stable income loss	Providing work-at-home jobs for the aged/ Remote work support system Lifelong learning infrastructure (u-learning)
Financial insecurity of social welfare due to the increase in the burden of health expenditures	Drugs for curing chronic diseases Inexpensive drugs for chronic diseases Custom-tailored exercise healthcare system
Increase in demand on age-friendly information devices	User-friendly interface
Difficulties in voluntary motion	Muscle assistance equipment Self-driving vehicles A vehicle system which is easy to control by the aged
Lacking in voluntary daily living ability	Muscle assistance equipment Daily living assistance robot
Information gap deepening	User-friendly interface

### 2.3 HCI Technologies in Response to the Aging Society Issues

Technologies required to implement the products and services in response to the aging society identified previously were identified. For this identification, a group of seven experts per each technological area was configured and total three workshops have been carried out. As a result, 75 candidate technologies were selected. With regard to these 75 candidate technologies, a survey was conducted to prioritize the technologies based on criteria of likelihood of success of implementation within 10 years, responsiveness to the aging society issues, and impact (economically and technologically) by the technology experts. The survey used a 5-point scale for each question. As a result, top 20 technologies in total were chosen as the core technologies. The table below shows some of them that can be categorized into the HCI technology among the top 20 technologies.

**Table 3.** Result of evaluation on the HCI technology

	Technology	Likelihood of success of technology implementation	responsiveness to the aging society issues	Impact	
				Economically	technologically
1	Brain-computer interface	2.83	3.14	3.78	3.95
2	Life-care service robot	3.17	3.48	3.50	3.58
3	Wearable power assisting suit	3.63	3.77	3.47	3.53
4	Natural language process	3.89	3.20	3.48	3.53
5	Autonomous vehicle	3.84	3.16	3.70	3.58
6	Automated manufacturing	4.22	2.44	3.61	3.16
7	Smart-work technology	3.98	3.55	3.41	3.27
8	Bio-signal based Human-computer interface	3.77	3.53	3.41	3.41
9	Artificial neural network	2.89	2.84	3.08	3.53
10	Life log data mining	3.61	2.64	2.95	3.02

### 3 Direction of the HCI Technology Development for Aging Society

By the categorization of the HCI technologies based on the evaluation results, future direction of the technology development was derived. First, in the cases of Brain-computer interface, life-care service robot, and Artificial neural network, which have low likelihood of success of technology implementation compared to their impact, it is required to invest in education for the skilled workforce in basic technology and related technology areas, taking the future impact into consideration. Second, technologies, which have higher likelihood of success of technology development but low economic impact, can be considered. These technologies have achieved their commercialization already but lacked their social penetration due to administrative limitation or market creation. Therefore, in order to accept the technology penetration by the society, the government should provide policies to create related markets. The technologies requiring the government institutional support are Wearable power assisting suit, Natural language process, Smart-work technology, and Bio-signal based Human-computer interface. Third, technologies, which have low likelihood of success of technology development but have high economic and social impact as well as having low responsiveness to the aging society, can be considered. That is, Life log data mining is not really difficult to implement currently but it is expected to have a low possibility of market creation and low demand in future. Hence, such technologies require re-review with regard to continual investment needs. Finally, technologies, which require technology development led by a private sector, can be classified. These technologies include Autonomous vehicle and Automated manufacturing, which have high likelihood of success of technology development and high economic impact. These areas are considered as being matured for commercialization and expected to create a sufficient market in future, which is preferred to be led by a private sector rather than being led by the government.

## References

1. Demiris, G., Hensel, B.K.: Technologies for an Aging Society: A Systematic Review of “Smart Home” Applications (2008)
2. Bouma, H.: Gerontechnology: emerging technologies and their impact on aging in society. *Stud., Health Technol. Inform.* 48, 93–104 (1998)
3. Charness, N., Scaie, K.W. (eds.): *Impact of Technology on Successful Aging*. Springer Publishing Company (2003)
4. Cash, M.: Assistive technology and people with dementia. *Reviews in Clinical Gerontology* 13(4), 313–319 (2003)
5. Rialle, V., Rumeau, P., Ollivet, C., Herve, C.: Smart Homes. In: Wootton, R., Dimmick, S.L., Kvedar, J.C. (eds.) *Home Telehealth: Connecting Care Within the Community*. RSM Press (2006)