Personal Robotics for the Elderly based on Interactive Technology

Myeung Sook Yoh* and Joongsun Yoon**

* POSTECH, Pohang, Korea
(Tel : +82-11-9104-1687; E-mail: gband@unitel.co.kr)
**School of Mechanical Engineering, Pusan National University, Pusan, Korea
(Tel : +82-51-510-2456; E-mail: jsyoon@pnu.edu)

Abstract: Recent advancement in technology raises fundamental questions: “what is right technology for human?,” “how can we build machines for human welfare?” Interactive technology and soft engineering deals with these problems. Personal robotics for the elderly seems to be a major area in which to explore these ideas. We can start by asking “what are inhumane human conditions to be resolved by technology?” Issues lain robotics for the elderly are described and desirable roles for the robots in such applications are presented. Interdisciplinary science approach is proposed to successfully implement this technology for the elderly.

Keywords: Interactive technology, soft engineering, personal robotics, technology for the elderly

1. INTRODUCTION

We are at the age of co-evolution of human and computers. Advent of intelligent machines is eminent and computers up to the level of adult intelligence will be ubiquitous in everyday life. In addition to human-level intelligence, human-like motions and movements will be very plausible. Then, fundamental questions raised are “What is right technology for human?", “How can we build machines for human welfare not to alienate human?” and “What are inhumane human conditions to be resolved by technology?” [1-3]

Aging is unavoidable truth, more fundamental than death. We don't know the time to die but we can't ignore being aged. As Simone de Beauvoir pointed out, “status for the elderly is most inhuman in the sense that it is not acquired but given.” This pointed out the despair which the elderly people suffer in that social interests determine (govern) the fate of the elderly and the elderly people can't modify the situation actively. This is true for the Eastern and the Western World alike.

More than half of the elderly people, who are over sixty five (65) years old in present Korea, live a life with average monthly income of less than two hundred thousand (200,000) won or approximately one hundred sixty (160) dollars. Eighty seven (87) % of the elderly people suffer chronicle diseases like Alzheimer's disease, paralysis, etc. They suffer hypochondria caused by a sense of isolation and alienation. While this may be unavoidable biological degeneration, abuse and frustration due to personal special situations have been deep-rooted social disease for long time. Considering the transition speed to the age of the elderly with which population of the elderly reaches 14.1 % of the whole population and covers the 20.8 % of the whole support budget for the elderly, this matter for the elderly must be resolved without delay in order to increase quality of life for society in general [4].

It is evident that current slogan or exhibitory welfare policy cannot solve the problems for the elderly. On the other hand, current welfare products are only affordable for the limited number of wealthy elderly people. Also, qualities of these products and services lack in the genuine user demands. This new industry treats the elderly persons as the potential exploiting means. If new project utilizes high technology and specialties of information age, fills the gap between national policy and private industry high technology, and compensate successfully, this can open the possibilities for providing new solutions for the elderly problem in general.

2. ROBOTS FOR THE ERLDERLY

There may be many views on the problems of the elderly. Three main issues for the elderly could be summarized as lack of economic affluence, physical health and emotional stability. Research on personal robots for the elderly has to be directed to alleviate these deficiencies and to improve life conditions of the elderly to affluent stage. Desirable roles of robots for the elderly include nursing, abuse prevention, companion, massagist, assistant in professional field, and helpers to household duties [5-8].

1) nursing

The elderly who have difficulty in movements or suffer Alzheimer’s disease need guardian attended. The shift in life style with nucleus families and working couples makes family members to take care of the elderly. Since it is often difficult to hire nurse to take care of the elderly due to the economic burden to the family members, house gets messy easily. Even if the economic situation is allowed to hire nurses, many cases have been reported that nurses do not treat the elderly respectfully nor abuse the elderly when family members are not attended. Nursing robot acting as a guardian and the first-aid can be a model for the robot which is more human tan human.

2) abuse prevention

High performance monitoring and security system equipped with cameras and networking may interfere the privacy of unspecified many people. Intelligent personal robots with the aid of the monitoring system can report hostile activities against the elderly protection laws and may prevent similar activities in advance [MR]. This could be major positive contribution of technology to the society.

3) companion

The issue regarding the suicide of the elderly is a serious societal problem in the countries which reaches aging society already. Irregardless of the economic poverty or illness, societal isolation and meaningless life make the elderly commit suicide. Beside them, there were no friends or family who listen their agonies and encourage their self-esteems. If counseling robot ct as a good companion and further a good community to connect people who shares common interests, they can considerably overcome the emotional disorders caused by societal isolation.

4) massagist

Major symptoms in the female elderly over sixty-five years old may be pain in the leg which make them difficult to walk. It is unsure this may come from the Korean females' unique body structures or lifetime hard housework. Many suffer the waist pain, arthritis and muscular disease. So far, massage by family members and physical therapists are only therapeudic solutions to this problem. Massge robot which can adjust the strength according to the physical characters of the elderly and repeat the process can be a popular item for the elderly.

5) assistant in professional field

The elderly who use to work in professional field are valuable intellectual warehouse with matured experiences and wide understandings. This expert knowledge and wisdom retire when they retire. This is a national waste and loss and can cause the frustration and helplessness. Even useful knowledges are separated from the possibilities of social utilization. Professional knowledges are provided to the user who need the experiences and insights. This in return elevates the self-esteem and satisfaction of the elderly and further guarantees certain amount of income. The secretary robot as an information broker can revolutionize the culture for the elderly and boost the knowledge related industry enormously.

6) helpers to household duties

If robot can do household activities including household cleaning, cooking, grocery shopping, and laundry, then the elderly or the housewives can enjoy recreational activities or invest more time on self development.

3. INTERDISCIPLINARY SCIENCE

After we explore the issues and areas in which technology can serve for the elderly, next question might be how we can build such a system. Soft engineering methodology based on interactive technology might be good way to implement this system.

3.1 Interactive technology

The most profound technologies are those that disappear. Silicon-based information technology, in contrast, is far from having become part of the environment. The idea of integrating computers seamlessly into the world at large runs counter to a number of present-day trends. Ubiquitous computing is not just aiming nomad multimedia. Rather, this computing environment lets us free to use computers without thinking and so to focus beyond them on new goals [9].

Human sensibility ergonomics deals with various problems of relationship between human and technology. It includes the subjects like 1) human as an emotional object, 2) interactions among human and machines, 3) realization of machine sensibility, and 4) comfortable feelings induced when accessing machines as an artistic object. Our interest is toward the exploration of human sensibility ergonomics as a soft engineering principle in terms of 2) interactions among human and machines [1, 10-15].

Interactions among human, machines and environment require new interpretations for the space among them. Traditional interactions among human and environment have been developed mainly around partial sensations like vision and hearing. Holistic interactions based on "Mom (embodiment)" suggest a good starting point to investigate new interactive technology methodologies. Metatechnology, soft engineering, Mom (embodiment), holistic interactions, tangible space, ubiquitous computing are key concepts in interactive technology.

Key ideas in interactive technology include synesthesia: unification of five senses-vision, hearing, smell, taste, and touch, examination of spatial perception, and emergence of a new perception; sensibility ergonomics for Koreans; mind based system; organic relationships among human and machines.

3.2 Interdisciplinary science

Robotics for the elderly requires interdisciplinary efforts, utilized in cognitive science, soft science, and meta science. Eyeball tracking project for the disabled people at the Stanford University portrays such successful efforts. Personal robotics for the elderly could be successful in this way.

Robots for the elderly should carry various functions, human-like intelligence, and psychological characteristics. The issues in artificial intelligence (AI) critical in robotics research have to be resurfacing.

When early AI studies got stuck over the search for the meaning of the intelligence, cognitive science evolved to overcome these difficulties and provide alternatives. Cognitive science is such an interdisciplinary field formed, based on philosophy, psychology, sociology, linguistics, brain neural science, computer engineering [16].

Robotics for the elderly also requires these interdisciplinary efforts. These include hard science: robotics, AI, physiology for the elderly; soft science: psychology for the elderly, studies of social welfare, science of nursing; and meta science: philosophy which deals robot ethics or robot axiology, cyber cultures [17-20].

The world first "eyeball tracking project for the disabled people" at the Stanford University portrays such successful efforts. This project was performed by interdisciplinary research efforts at a cognitive science institute, the Center for the Study of Language and Information (CSLI). Eyeball tracking system is a computer interface system activated by the tracking eyeball movement instead of mouse or keyboard. The handicapped person, who cannot use his hands and/or foots, inputs letters and activates commands by looking at the letters on the computer screen [21].

To implement this system, linguists, natural language programmers, computer engineers, brain neurologists are involved in the front line. This interdisciplinary research group refined and improved the quality of the system by conducting many open seminars. They sustained and overcame many harsh comments from the philosophers and actual handicapped groups. The most appeal comes from the projector leader, who is a business management person. He suffered a paralysis from diving accident. Even if he can't do anything except see, hear and talk, he sent emails to worldwide institutes and send messages what time he can go home to a limousine company for the handicapped.

This eyeball project suggests a successful way how we could conduct successful projects regarding personal robotics for the elderly.

4. SUMMARY

When the technology level of the countries or institutes are similar, the success or failure of the projects on the technology for human depends on how we select the project and how we conduct open research. Some Issues lain robotics for the elderly are described and desirable roles for the robots in such applications are presented. Interdisciplinary science approach is proposed to successfully implement this technology for the elderly.

Interactive technology initiative (ITI) is an interdisciplinary research group to search proper technology and way of implementing technology. Some thought experimental activities conducted by ITI are presented.

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