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ROBOTS WITH AND FOR THE ELDERLY PEOPLE – CASE STUDY BASED ON ACTION RESEARCH

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Abstract

There are lot of challenges how to tackle the questions of ageing society and ageing population in European countries. The demand is to develop new digital health and wellbeing services using technology and robots for elderly people to promote elderly people´s health and wellbeing and to support them to cope and live independently at home. Based on earlier studies the main problems of elderly people who are living alone are loneliness, unsafety and difficulties in daily life. The challenge is to response the needs of elderly people. The solutions will be new technologies, robotics and new digital services enhancing and supporting elderly people living at home as long as possible.

This article is based on an action research and living lab methodology for developing and studying how to apply robots in elderly care. Action research as the methodological approach is congruent with the living lab methodology especially when the aim is to develop and pilot new activities, methods or interventions for example robots such as service robots, care robots or social robots with users in real life. In this study both elderly people and and health care professionals are in an active role and engaged in the development process of using robots in elderly care. The purpose is to present the findings of case study based on the phases of action research in the context of elderly care.

The purpose of this article is to describe the research and development process and cocoreation process how robots and the content for program can be developed and piloted in elderly care. The aim of is to describe a living lab study and design plan for how care robots especially Pepper was piloted in elderly care context. The methodological background is on action research. The data was collected through focus group interviews and demonstrations of the robots before, during and after the pilots. This study is a part of the main research project called Robots and Future of Welfare Services (ROSE) funded by Strategic Research Council, Academy of Finland [1]. The main research project adopts a multidisciplinary and holistic approach to study how advances in robot and perception technologies allow product and service innovation and renewal of welfare services, when such services are developed jointly with users and other stakeholders to respond the needs of the elderly people.

Keywords: Action research, care robots, design process, elderly people, home care, living lab.

1 INTRODUCTION

Almost every country in Europe is tackling today with the huge challenges of ageing society and ageing population. The Program for Active and Healthy Ageing was published as “The European Year for Active Ageing and Solidarity between Generations year 2012” [2]. From the point of view elderly people as senior citizens there is still a need for supporting elderly people´s health and wellbeing through the development of the new health and wellbeing technology, eHealth and especially through new digital services [3]. The digitalization is spreading rapidly reflecting on all levels of the society and especially people´s everyday life. The elderly people as users and clients in the health care and social welfare should be taken actively along when technological products, robotics and digital services are developed. Cities or municipalities, companies, academic institutions, and professionals from public and private healthcare and social welfare field, Third sector, and e.g. elderly people as users should cooperate for co creating better user-driven and age friendly services.

Digital revolution, automation and robotisation play an important role in finding out new solutions to actual societal challenges such as aging the population and developing welfare services and the productivity of welfare services [3]. The evolution of artificial intelligence, robotics and cognitive robots have been seen as one way to develop new services, improve the quality of their services, and increase productivity. Successful interaction between humans and robots is one of the most important challenges of future technology [4]. The development of artificial intelligence and robotics will enable services to be reformed, improve the quality of services and increase their productivity. Successful interaction and communication between man and robot, however, are major challenges for the future

in the development of technology. [5]. Robots used in welfare and health can be divided into medical robots, plant environment robots, personal assisted robotic technologies, and care robots. Robots can be viewed and labeled as care robots, service robots and social robots. [6]. Care robots are often linked to a nursing or health care professionals' technological tools to take action, assist, or transfer or raise a client or patient. Care robots can also be utilized in clients´ rehabilitation. Service robots are mobile and can be used to monitor elderly people´s body functions, to stretch items, to remind them, and to alert them. The service robots include technology, programming and are offering contents or services. Based on earlier studies the robot allows closed remote access to an elderly person, to a significant other or a relative, and a nursing worker. [7]. Social robots interact with people and even allow them to follow. They offer activations like various games as well as social interaction and discussions. [8]. Social robots can also be used to promote elderly people´s health and well-being, rehabilitation and learning. The robot can even diagnose, prevent and reduce isolation, depression, or even dementia. [9].

2 METHODOLOGY

2.1 Action Research and Living lab methodology

This article is based on an action research and living lab methodology for developing and studying how to apply robots in elderly care. The action research process implies that the subjects of research are active participants in the research process, and that the process is cyclical, including planning, action, evaluation and reflection [10]. An action research is can be seen either as methods or as a methodological approach. The basic principles of action research are practicality, actors´ participation and the creation of new activities or interventions related to the concept of change. The cyclic process of the action research is strongly anchored in a real life. [10]. The cycle of the action research applied in this study (figure 1.)

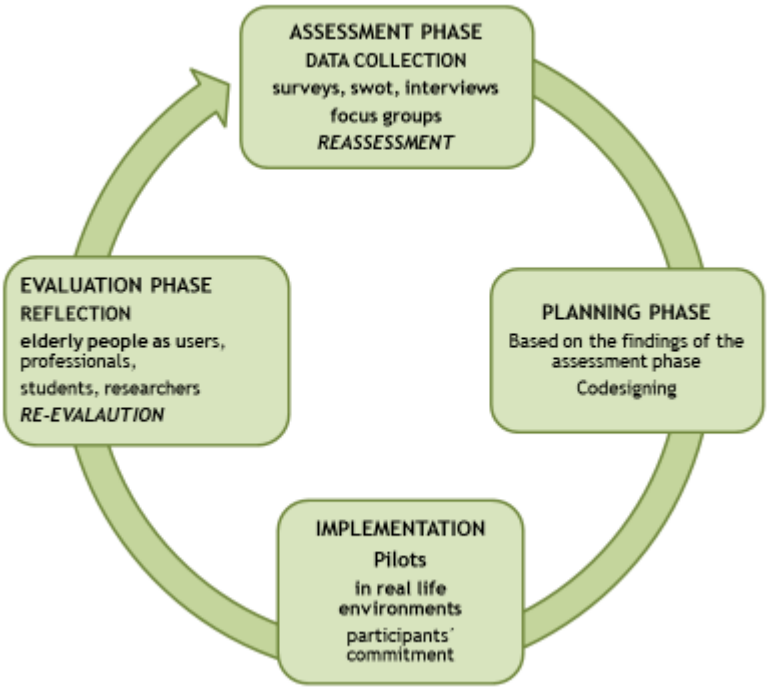

Figure 1. The cycle of action research.

In this study both elderly people and health care professionals are in an active role and engaged in the development process of using robots in elderly care. The purpose is to present the findings of case study based on the phases of action research in the context of elderly care.

According to Ericson et al (2006), a living lab is a network that integrates both user-centered research and open innovation [11]. Living labs offer research methodology through which Innovations are created and validated in collaborative real-world environments. The Living lab methodology is based on the active participation of, and the development and creation of, different actors for example, users.

The way to work in the living lab context is bottom-up action that is central to the real life environments and situations. Environments can be both physical and virtual environments. [12]. the user can be in different roles, such as a reporting agent, a tester, a contributor, or a joint producer. Living lab is a network that integrates an user-centered research and an open innovation [12]. Leminen et al. [13] defines living labs as physical regions or virtual environments where public-private-people partnerships, companies, academic institutions and users create, test and validate new products and services in real life situations.

The basic principles of living lab are quite congruent with the action research because both research interest are focusing on practice, actors´ involvement and the creation of producing new knowledge. In this project elderly people as users and health care professionals were in an active role in the development process of health technology and services. The findings of the action research will be described in the context of the development environments from eldelry people´s point of view.

2.2 The purpose and the data collection

In this article, the purpose is to describe the research process for the pilots using robots in elderly care. The aim is to plan and implement the content program for the Pepper robot based on cocreation process in real life environment.

The research tasks are:

How robots can be used with and for the elderly people in home care context?

How the action research is applied for the pilots of care robots in elderly care?

The living lab methodology was the basis for the data collection for planning and implementing the pilots with the Pepper robot. During the data collection process, mixed methods, such as focus group interviews with SWOT analysis, surveys, videos and demonstrations were used. A small municipality in southern Finland has been the context for living lab research in this study. Both elderly people (N=17) living at service house or at private homes and home care professionals (N=40) have participated in the study.

The data was collected in two phases. In the first phase, the participants in the study described individually their own work day at home care by drawing and writing episodes of client visits and telling how much time is spent on different episodes during one working day. After that, the research data was collected by focus group interviews, whereby the current state of home care was mapped. In the second phase of the data collection, home care workers' conceptions, expectations and ideas about the possibilities of care robots for elderly care were collected. In focus group interviews, participants are actively interacting with each other [14]. The benefit of focus group interview is to activate the information from another participant, offering more in-depth knowledge of the research phenomenon [15].

The research data was analyzed by inductive qualitative content analysis. Dey defines inductive content analysis as a three-step process, in which the data is first reduced, then grouped and ultimately theoretical concepts are created. Interview data was transcripted word by word. [16]. The starting point for the analysis was based on reading the data, after which it was coded and reduced to expression. Sub-categories, categories and the main categories were created inductively. The main categories were named as theoretical concepts. [16] [17] [18] [19].

2.3 Results

2.3.1 Description of the present situation in home care

The professionals of home care described the current situation in home care: clients in home care, conditions in home care environments, home care attendance and used time there, and home care challenges. Clients´ situation in home care showed the status of elderly people´s health and overall wellbeing, problems of loneliness and insecurity as well as lack of functional capacity and ability to move and relationship with family members or significant others. The clients are in quite poor condition and have multiple diseases. Often elderly people have memory problems. The need for the help at home is connected activities of daily living and inadequate ability to cope alone at home. Based on home care workers´ descriptions of elderly people coping at home are becoming more and more challenging, with professionals´ support and needed help. Illness or home falls reflect a change of state of health and occur in acute situations in home care. Loneliness, living alone and anxiety as well

as uncertainty and frustration combine the solitude and insecurity of the elderly people. Often family member who is taken care of her or his own spouse has quite poor condition or illness, and the need for help requires support for the whole family.

Circumstances in home environments were descried based on the categories of physical home environment and challenges in basic home environment, and variability of premises and conditions. The content of the work in home care included home care visits and time used there. During the home visit home care workers described their own actions such as clients´ various measurements, contacts to hospitals, requests and consultations, overall assessment, as well as situation-specific assessments, records and data management, as well as time for discussion and presence with the client.

The challenges of home care during shift work related to changes in the health status of the client, transitions from home to hospital or from hospital to home, inquiries and consultations, changes in work shift and job shifts, and work content at the office. The sudden illness of a client affects the homecoming situation, which means that the client's transfer to the hospital requires several functions. Situations related to hospitalization often occur at short notice and require fast delivery of transportation, pharmacy and other home help. Many queries and consultations through the phone during the home visit load the workday. Changes in the workflow caused to additional home visits, office visits, or pharmacy visits. An illness of a worker or a colleague during the shift causes changes in work shift. Part of the content of home care work needs the office environment, whereby client data, various notifications, emails, and information related to the day program will take time with the computer. The content challenges of home care are related to the use of information technology, document writing, time-consuming work, information flow, and updating of professional skills. Concern for the client means concern about her or his coping at home.

2.3.2 Developmental ideas

The data was collected during the focus group interviews and demonstration sessions. The needs and expectations of the robots in elderly care were mapped and clustered as developmental ideas. The use of robots in home care were related to robot as versatile reminders, robots´ possibilities in home care, and robot in the overall situation of a client

Based on the analysis the three main categories were grounded on the data. These findings showed that robots can be useful as

1 Versatile reminder such as reminding the day, time or activities of daily living,

2 Possibilities of robots in elderly care mean the role of robot as helping or assisting, checking up and monitoring, supporting safety and offering interactive contents and program such as gym exercises, reading and telling stories, news, playing games e.g. bingo and other games, which support and activate elderly people´s memory,

3 The robot in client´s holistic situation meaning reciprocal agreement and ethical guidelines.

The robot as versatile reminder included the following subcategories: robot monitors and alarms, robots support security and support of the client, robot as a substitute operator, the benefit of remote connectivity, and robotic content expectations. The participants suggested many ideas how a robot can be programmed form the content point of view. The content-based developmental ideas emphasized physical exercises especially gym sessions.

"If there was a robot that said, "Now jump, get up, and sit down". Then it moves the hand, so it is a different matter and it would otherwise be that your client would only sleep. "

The participants suggested robot e.g. for reading, music, movies and games that reduce elderly people´s loneliness. Robots can bring variations in daily life. Also via a robot rehabilitation and gym, exercise can be repeated several time during the day. Robots can ease activity of daily living such as cleaning, remaining lunch, weekday, time etc. Especially Pepper robot was seen as accompany for the elderly in order to keep connected the others. Robot can be as a physical assistance lifting a thing from the floor or telling where to find e.g. cloths. All in all robots can improve a lot safety at home environment not only monitoring but also alarming.

2.3.3 Implementation the Pepper pilot

The demo sessions of five different robots were organized and both the elderly people and professionals participated in. The findings of the data collection were the basis for planning the pilots

and chosen the Pepper robot. Two pilots with Pepper robot were implemented spring 2017. One was Bingo event with Pepper and the other one was Pepper as guiding the gym exercise for the elderly people.

The design for the gym and bingo were planned and the text as a story for the manuscript was created. The contents were carefully chosen based on participatory observation and videotaping from the real life gym session. The manuscripts were evaluated and corrected by the professional physiotherapist. In addition, the voices and pictures were integrated with the the story content before coded and programmed to Pepper. (Figure 2)

Figure 2. Gym with the Pepper (photo by Jaakko Porokuokka 2017).

Twelve elderly people participated in gym session guided by Pepper in May 2017. Elderly people were involved and participated activly during the session. After gym session, feedback was asked and collected from elderly people. All most everybody enjoyed and said that it is easy to follow Pepper´s voice and movements. The future challenge is to develop and connect the small iPad of the Pepper to the bigger screen. Many interested professionals observed the pilot situation and some of them even participated in the gym session. All participants were enthusiastic and wanted to continue more pilots with the elderly. The feedback from elderly people, professionals and stakeholders were very positive an encouraging for planning the future pilots using Pepper.

3 CONCLUSIONS

The challenge is to response the needs of elderly people, their significant others and professionals in home care using possible robots. It is important that new technology and robotics will be developed, piloted and studied. Based on this article and the findings of the study the contents and services using robots in elderly care should be continued, piloted and evaluated more and more in real life situations. Testing and piloting of different types of robots such as social robots and care robot with different actors to develop new services requires more knowledge and research from a user perspective. The pilots should be studied through multiple research methods with various actors. The aim of modernizing elderly people's services is to develop and deliver innovative services as a whole so that users are also actively involved in development work. Designing the study according to the living Lab methodology would strengthen the user's involvement and commitment to modernize services. It is also essential to continue research by systematically assessing the effectiveness of care robots in the home care context. Planning a research in real life situations and real operating environments as an intervention study would allow the knowledge of the role of the robot and the interaction between human and robot.

The change in work in health care and social welfare field requires multidisciplinary research in order to achieve real improvements especially from the client point of view. Approximately one third of home-care workers in the municipal sector in Finland will be retired by 2020 [17]. This demand

requires both the rapid updating of present home care services and the updating of skills and competences of professionals working in home care. A changing labour force creates new opportunities for both public healthcare and private health care service companies to develop their services especially for the elderly people. The use of technology and robotics in health care and social welfare fields requires a new and innovative expertise, education and leadership. A research is for the development curriculums and educating professionals and students in order to enhance new knowledge, methods and contents. [18].

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REFERENCES

[1] Robots and the future of welfare services (ROSE). http://roseproject.aalto.fi/

[2] EU 2012. Digital Agenda in the Europe 2020 strategy. http://ec.europa.eu/digital-agenda/en/digital-agenda-europe

[3] Digital Agenda in Europe 2012. http://ec.europa.eu/digital-agenda/en/digital-agenda-europe

[4] E. Broadbent, N. Kerse, K. Peri, H. Robinson, C. Jayawarddena, T. Kuo, C. Datta, H. Butler, P. Jawalkar, B. Amor B, B. Robins and B. MacDonald B, "Benefits and problems of health-care robots in aged care settings: A comparison trial," in Australasian Journal on Ageing, 35(1), 23-29, 2015.

[5] SPARC 2016. Strategic Research. Agenda 2014-2020 for robotics in Europe SPARC The partnership for robotics in Europe. http://roboproject.h2214467.stratoserver.net/cms/upload/PPP/SRA2020_SPARC.pdf

[6] M. Kangasniemi, A-M. Pietilä A-M and A. Häggman-Laitila A. "Automatiikka ja robotiikka hoitotyöntekijöiden työn muutoksessa, " in Tutkiva Hoitotyö. 14(2), 40-45. 2016.

[7] R. Kachoie, S. Sedighadeli, R. Khosla and MT. Chu MT. "Socially assistive robots in elderly care: a systematic literature review, "in International Journal of Human-Computer Interaction. 30, 5, 369-393, 2016.

[8] M. Mataric', A. Okamura and HA. Christensen. "Research Roadmap for Medical and Healthcare Robotics," in A Roadmap for US Robotics. 2015. From Internet to Robotics; http://www.us-robotics.us/reports/CCC%20Report.pdf

[9] S.M. S. Khaksar, R. Khosla R, M.T.Chu and F. Shahmehr. "Service innovation using social vulnerability among older people in residential care facilities," in Technological Forecasting & Social Change.113, 438-453, 2016.

[10] P. Reason and H. Bradbury, H. The Sage Handbook of Action Research: Participative Inquiry and Practice. 2nd edition. London: Sage Publications Ltd, 2008.

[11] H. Erikson and M. Salzmann-Erikson. "Future Challenges of Robotics and Artificial Intelligence in Nursing: What Can We Learn from Monsters in Popular Culture?" in The Permanente Journal Jul (20 (3), 215-243, 2016.

[12] S. Leminen, M. Westerlund and A-G. Nyström. "Living Labs as Open-Innovation Networks," in Technology Innovation Management Review. 6-11, 2012. www.timereview.ca

[13] S. Leminen. Living Labs as Open Innovation Networks. Networks, Roles and Innovation Outcomes. Doctoral dissertations 132/2015. Aalto University, School of Science, Department of Industrial Engineering and Management Learning Organizations.

[14] The Living Lab Methodology Handbook. http://www.ltu.se/cms_fs/1.101555!/file/LivingLabsMethodologyBook_web.pdf

[15] DW. Stewart and PN. Shamdasani PN. "Focus groups: Theory and practice." Third ed. Thousand Oaks, California: Sage Publications, 2015.

[16] MQ. Patton MQ. “Qualitative research & evaluation methods.” 4. ed. California: Sage, 2015.

[17] I. Dey, I. “Qualitative data analysis: a user-friendly guide for social scientists.” London: Routledge, 1993.

[18] S. Elo and H. Kyngäs. “The qualitative content analysis process.” in Journal of Advanced Nursing. 62, 107-115, 2008.

[19] D. Silverman. “Doing qualitative research. A practical handbook.” London: Sage. 2000.

[20] J. Tuomi and A. Sarajärvi A. ”Laadullinen tutkimus ja sisällönanalyysi.” Latvia: Livonia Print. 2009.

[21] I. Holloway and S. Wheeler S.”Qualitative reserach in nursing and health care.” Oxford: Blackwell. 2010.

[22] Statistics Finland 2015. Official Statistics of Finland (OSF): Preliminary population statistics [e-publication].
ISSN=2243-3627. August 2017. Helsinki: Statistics Finland [referred: 26.9.2017].
Access method: http://www.stat.fi/til/vamuu/2017/08/vamuu_2017_08_2017-09-21_tie_001_en.html

[23] A. Kristoffersson, S. Coradeschi, A. Loutfi and K. Severinsson-Eklundh K. “An exploratory study of health professionals’ attitudes about robotic telepresence technology.” in Journal of Technology in Human Services. 29, 263-283, 2011.