

M. SIMONOV (Convener). A socially assistive robot for persons with Chronic Obstructive Pulmonary Disease (COPD). Gerontechnology 2012;11(2):353; doi:10.4017/gt.2012.11.02.150.00 **Participants:** *M. SIMONOV (Italy), W. YAN (Germany), R. CUIJPERS (Netherlands), D. LOWET (Netherlands).* **ISSUE** Smart home technologies and social robots for COPD-care at home. **CONTENT** COPD-patients have an overall gradual decline in functions accompanied by acute periods of exacerbation. Different COPD-care schemes aim to prolong the independent living, but all of them require information about the normal and acute periods, calling for regular measurements of relevant parameters in home settings. We discuss a robot-based application¹ which includes the elaboration of historical series of data (about the environmental, medical conditions and trends) for the medical assessment and care operations. Institutionalized health care costs in Europe increase while the availability of care personnel decreases.² We discuss a solution that allows people to receive quality care, satisfying at the same time the desire to stay at home. By including robots in the process, the quality offered by some typical social services is enhanced. This symposium addresses a specific age-related disease (COPD) and the use of smart home technologies in support of people suffering from this disease: how to ubiquitously monitor health and well-being in combination with social robots interacting with humans in a natural and acceptable way. One of the 7th Framework Program EU research projects on new technological enablers for home care is KSERA - Knowledgeable Service Robotics for Ageing¹. It brought together seven partners from five different countries developing a Socially Assistive Robot (SAR) that helps older people, especially those with COPD, in their daily activities and care needs. It provides the means for effective self-management of their disease seamlessly integrating socially assistive robots in smart home environment. We discuss how to obtain a successful, effective interaction between people and the mobile robot to guarantee acceptance and adoption of service robotics technology, providing the added value of ubiquitous monitoring services. **STRUCTURE** (i) Capturing and triggering relevant daily living events and processes by Ubiquitous Monitoring, by Mikhail Simonov of ISMB. (ii) Operating and navigating robots in domestic environments, by Wenjie Yan of UH. (iii) Robots in ambient assisted living (AAL): an industrial perspective, by Dietwig Lowet of Philips. (iv) Human robot interactions in care applications by Raymond Cuijpers of TU/e. **CONCLUSION** The symposium looks at the combination of different technologies such as ubiquitous monitoring, operating robots, and using advanced Human-Robot Interface (HRI) to offer social assistive services with a natural and acceptable interaction design. We try to capture the consensus about valuable and feasible functionalities, also offering the chance to exploit the technology at industrial levels looking from different viewpoints. Having shown how to aggregate environmental data including information about indoor/outdoor conditions and daily living activities, the challenge becomes interacting with patients using social assistive robots in the domestic environment, when needed. Robot-based applications can interact with the patients in an almost natural way proposing interesting and convincing stimuli, like the demonstration of respiratory exercises, to improve health conditions.

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R.H. Cuijpers, J.F. Juola, D. van der Pol, E. Torta. Human robot interactions in care applications. Gerontechnology 2012;11(2):353-354; doi:10.4017/gt.2012.11.02.186.00 **Purpose** Potentially, a (small humanoid) robot could extend a smart home environment and help older people to live in their own homes for longer. Clearly, such a robotic system could help reduce health care costs in the future. However, placing a robot in the homes of older people introduces many problems. The robot should be able to move about in cluttered and unknown environments, it should be able to approach a person; it should communicate, take context into account, respond and interact, make decisions and so on. What do users need most of all? What are the requirements?

What are the ethical issues? **Method** Many of these issues are addressed in the KSERA-project. In this talk I will focus on the human robot interaction. Not only must the robot be able to interpret a person, it must also provide understandable cues for a person. From cognitive psychology we know that humans interact by internally simulating another person's behaviour. As human beings are in many ways similar, the human brain is able to predict and infer the goals of another person¹. Robots on the other hand are typically unlike humans and as a result their behaviour seems unpredictable. They do not interact in understandable ways causing them to appear clumsy and stupid². **Results & Discussion** We report how recent insights in cognitive psychology can help build robots that take human-robot interaction to the next level and that, ultimately, can be used to help older persons at home.

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D.J.C. LOWET. Robots in AAL: An industrial perspective. Gerontechnology 2012;11(2):354-355;

doi:10.4017/gt.2012.11.02.211.00 **Purpose** The Florence project (Multi-purpose Mobile Robot for Ambient Assisted Living) aims to improve the well-being of the elderly (and that of their loved-ones) as well as improve efficiency in care through AAL-services supported by a general-purpose robot platform. The Florence system uses a low-cost multipurpose mobile robot platform for delivering new kinds of AAL-services to elderly persons and their caretakers. The main objective is to make this concept acceptable for the users and cost effective for the society and care givers. Florence aims to put the robot as the connecting element between several stand-alone AAL-services in a home environment as well as between the AAL-services and the elderly user. The Florence project focuses on application services in the areas of social connectedness (e.g. robotic tele-presence), coaching (life-style improvement) and safety (e.g. emergency situation handling). **Method** Low cost, application platform, and user acceptance are important considerations in bringing the Florence technology to market. The Florence project uses a platform approach in which a distinction is made between a generic robot platform and the various application services –potentially developed by different service providers—that this platform can support¹. To achieve a low-cost platform a simple robot is used based on wheel-based platform and a touch screen for interaction with the user. Integration with the smart home is achieved through a context management framework (CMF) that offers a unified interface to the sensors and actuators of the smart home, including the sensor and actuators of the robot². The Florence platform offers services like robot navigation, decision-making, user interaction via speech, gestures, etc. On top of this platform a number of application services are developed: robotic tele-presence, both for social connectedness and for emergency handling, a coaching service for life-style improvement, an interface to interact with the smart home and a vital signs monitoring service. **Results & Discussion** The Florence project uses an iterative approach. At the start of the project focus groups and Wizard-of-Oz tests were conducted to gain a better insight in the needs of the elderly that we want to address. Based on these results requirements for the various application services were identified. Two implementation iterations were planned. The first iteration is now finished and will be tested with end users in January 2012 in a controlled home lab environment (Philips Home Lab and OFFIS Living Lab). Based on the feedback of these results a second iteration will be implemented; this second iteration of the Florence platform and services will be tested with end users at their home at end 2012.

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M. SIMONOV, A. FRISIELLO, M. BAZZANI. **Capturing and triggering relevant COPD events and trends by ubiquitous monitoring.** *Gerontechnology* 2012;11(2):355-356; doi:10.4017/gt.2012.11.02.203.00

Purpose Patients with chronic obstructive pulmonary disease (COPD) have an overall gradual decline in functions accompanied by acute periods of exacerbation. For this reason they are vulnerable to unfavourable environmental conditions. The KSERA-system¹ processes the information about both the normal and the acute periods, reminding the patients to perform the measurements of relevant parameters through the use of a social robot. Cognitive capabilities²⁻³ are used to manage the exacerbation periods through monitoring, collecting data, and applying the rules to discriminate among several real-life situations⁴. The authors propose a COPD-care application which collects historical series of environmental and medical data for the medical assessment⁵ before actuating care operations. **Method** In KSERA¹, the ubiquitous monitoring subsystem (UMS) acquires in- and outdoor environmental parameters complemented by vital signals coming from the validated multi-sensorial wearable device ADAMO⁴. The main information set (temperature, humidity, and CO-levels) comes from the physical sensors, while new data, like particulate matter (PM) levels, is generated by virtual sensors or web services. In this way the information flows become persistent, enabling performance of analytical processing of the historical series using trend-revealing data-warehousing algorithms. The persistence of high PM-levels for many days is likely to cause COPD-exacerbations. In such a situation, a warning is sent to the patient using the anthropomorphic interface represented by the social robot. Triggering rules are detailed in the KSERA-Deliverable D1.2¹. **Results & Discussion** KSERA UMS includes several sensors and web services describing in- and outdoor, patient mobility and healthy living parameters daily. The historical series help to discriminate among the different conditions and trends listed in 'use cases'. Usability tests showed the higher perceived efficiency (3.3 in Likert scales) of involving the patient in the self-management process through the social robot compared with the other communication channels. We approach the user attempting to persuade him/her to use social communication with the robot. KSERA-prototype proposes one personalised respiratory training program (tuned using SpO₂ measured values) based on the robot in the place of need. One use case detects missing the daily SpO₂-sample and makes the robot move close to the patient, asking him/her⁶ to perform the forgotten measurement. The usability aspects were evaluated in Italy, while the field trials were undertaken in Austria and Israel. KSERA-results are available online¹. Thanks to this PM-trend monitoring functionality, the KSERA-system has the capacity to gently inform on harmful outdoor conditions in case of "patient venturing outdoor" actions. By showing the correct arm movements, the robot persuades the COPD-patient to perform the physical exercises with better results than using traditional LED-multimedia projector. The effectiveness of the exercise can be communicated by the patient to the robot in a simple, social-like communication. Using the robot to inform patients about pollution and exacerbation risks appears to be convincing. The social robot acting inside the house fully implements ubiquitous monitoring features. Currently, KSERA uses the robot to approach the patient with warnings about potential risks. In the future, the system is expected to correlate the collected data with the intention of the patient to leave the house: in such a case, an early, preventive warning can be issued with longer notice.

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W. YAN. **Robot navigation for assisted living.** *Gerontechnology* 2012;11(2):356; doi:10.4017/gt.2012.11.02.190.00 **Purpose** As the field of robotics matures, elderly people can increasingly benefit. For example, the KSERA project proposes a mobile robot that serves as a communicative interface as part of an ambient-assisted-living (AAL) home. Robotic navigation, in particular mutual positioning between the robot and the person, is one of the prerequisites enabling the robot to serve the person. However, indoor robot navigation is still a challenging task due to the high complexity and possible dynamic changes within homes. The system should safely interact with users without requiring expert knowledge and costly or distributed sensors in the home; the system should also be easy to install and to maintain. **Method** We have developed a hybrid probabilistic neural model simultaneously tracking a person and a robot using a single ceiling-mounted camera with a fish-eye lens¹. Based on vision technologies, different visual cues are computed and integrated in a Sigma-Pi-like network². A short-term memory mechanism modeled via particle filters enhances the robustness of the tracking system. Using the person's location obtained from the tracking system, a cognitive map is built for robot navigation. While updating the cognitive map, an inverse control model of possible navigation within the map is trained. The robot will plan the path to approach a person based on the cognitive map and navigate naturally. Since the robot's navigation is not based on a geometrical model, our system can work without camera calibration. Instead, it maps the room by the person's ordinary movement without any extra knowledge. **Results & Discussion** A detailed case study has been conducted to evaluate the model. As shown in Figure 1 left, a person and a robot are localized simultaneously in a home environment. A cognitive map is built up based on the person's movement (Figure 1, right), and the navigation is planned by searching for the brighter units in the map, which leads to the robot approaching the person. Since the entire system only needs a simple ceiling-mounted camera as sensor input, and the room mapping can be done in a simple way, we conclude that our system is appropriate for indoor robot navigation in an ambient home.

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Figure 1. Ceiling-camera view of an apartment; Left: A person and a robot are localized; The spots are particles for the robot and the user; Right: The units and the links of the built cognitive map