A Personalization Platform for Older Adults with Mild Cognitive Impairments

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Teaser: A platform for personalizing remote assistance of older adults with mild cognitive impairments aimed at caregivers without programming knowledge in order to help seniors in their daily activities at home

Using ICT technologies to prolong the time elderly people can live independently in their preferred environments can open up many interesting opportunities. However, there are several barriers and obstacles for actual seniors' use of existing technologies: older adults are different (e.g. in terms of attitudes towards technology, physical/cognitive limitations, needs, interests); elderly needs are not static, they are likely to evolve over time depending on e.g. evolving health conditions, preferences. Thus, the possibility of personalizing the ICT-based support is a fundamental challenge. In the AAL PETAL project we are developing a platform for personalizing remote assistance of older adults with Mild Cognitive Impairments, with particular attention to the support of lighting systems in order to provide orientation over time and in space. This category of users suffers from cognitive issues, such as the tendency to forget tasks/events and/or other issues such as cardiovascular issues, reduced sight, irregular eating habits, often associated with increased risk of social isolation and depression. The platform aims to support monitoring user's environment and behaviour, as well as personalizing applications and controlling devices to better support seniors in their daily living. Thus, it exploits smart objects such as lights to support the elderly in terms of activation or relaxation stimuli, generation of alerts and reminders for physical and social activities, orientation over time and space, and sleep quality. The caregivers and older adults can set the functionalities of the technological support to control lights and other digital devices when relevant events occur. In this way it is possible to obtain personalized control of lights and other digital appliances, personalized warning messages issued in risky situations, and persuasive messages to stimulate the elderly in healthier habits (e.g. doing more physical activity). The possible personalizations are expressed in terms of simple trigger-action rules [1, 2, 3]. Triggers represent situations/events that caregivers could be interested to know regarding the elderly: e.g. health/cognitive/emotional status, cognitive/physical/social activity, especially when they are away from them (remote monitoring). The information associated with triggers is derived by various sensors (e.g. motion, proximity, lights, noise, respiration, heart). Actions represent what the technological equipment at elderly's disposal at home could do: control appliances (e.g. switch on/off lights, close/open doors, play tv/radio), send reminders, send alarms, provide info about their needs. Examples of personalized rules that can be obtained with this approach are:

- When the user leaves the house and it's going to rain remind her to take the umbrella with a message on the phone
- Send a message to the caregiver when the user leaves home during the night
- When caregiver sends a message "where?" answer automatically with user location
- If the user has not done the planned cognitive exercises blink the light to remind him to continue this activity

- If the user is close to the living room and time is 4 p.m. turn on the TV

We have organized trials in homes with older adults with mild cognitive impairments distributed across various European countries (Figure 1 shows one home involved in the trials). Figure 2 shows the types of sensors, objects, and devices we use in such trials. Each user has a tablet, and a smartwatch. We have selected a smartwatch that, in addition to detecting physiological parameters such as heart rate and step counter, is able to connect and communicate at the same time through Bluetooth and Wi-Fi. This is exploited to obtain indoor positioning with the support of proximity beacons. In terms of light we use the GREAT luminaire (designed by Bartenbach, a company involved in the PETAL project), which aims to provide health stimulating, biorhythm-stabilizing, high-quality light for high visual demands and creates an activating or calming room ambiance with different light scenes. The extremely high light intensity (1000 lx at the eye level) of the GREAT luminaire leads to effects comparable with classic light therapy within 5 hours of use. It compensates missing daylight and provides distributed light within a whole room of about 16 m^2. In addition, we use various types of Philips Hue lights to support similar effects in other parts of the home. Further sensors used are able to detect gas, smoke, humidity, use of objects, whether windows or doors are open and so on. The platform is also connected with an app developed by Ideable (a Spanish company involved in the PETAL project), which supports serious games for cognitive stimulation in order to allows caregivers to define rules depending on the cognitive and emotional state or depending on the training results.

Such technological setting is exploited through an instance of a personalization platform that includes a middleware (context manager) able to gather raw information from the various sensors and convert it in data that can be analysed in terms of logical events and conditions. In this way when the personalization rules are created by the older adults or their formal or informal caregivers it is possible to detect dynamically when they should be triggered and the consequent actions performed.

[1] Ghiani, G., Manca, M., Paternò, F., Santoro, C.: Personalization of Context-dependent Applications through Trigger-Action Rules. ACM Transactions on Computer-Human Interaction, Vol.24, Issue 2, Article N.14, April 2017.

[2] Huang, H., and Cakmak, M., 2015. Supporting mental model accuracy in trigger-action programming. In Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp '15). ACM, New York, NY, USA, 215-225. DOI=http://dx.doi.org/10.1145/2750858.2805830

[3] Ur, B., McManus, E., Ho, M.P.Y., and Littman, M.L. (2014). Practical trigger-action programming in the smart home. CHI 2014: 803-812

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Useful links

The PETAL project, http://www.aal-petal.eu/

The HIIS Laboratory at CNR-ISTI, https://giove.isti.cnr.it/lab/home

Figure 1 – An example of home involved in the trials

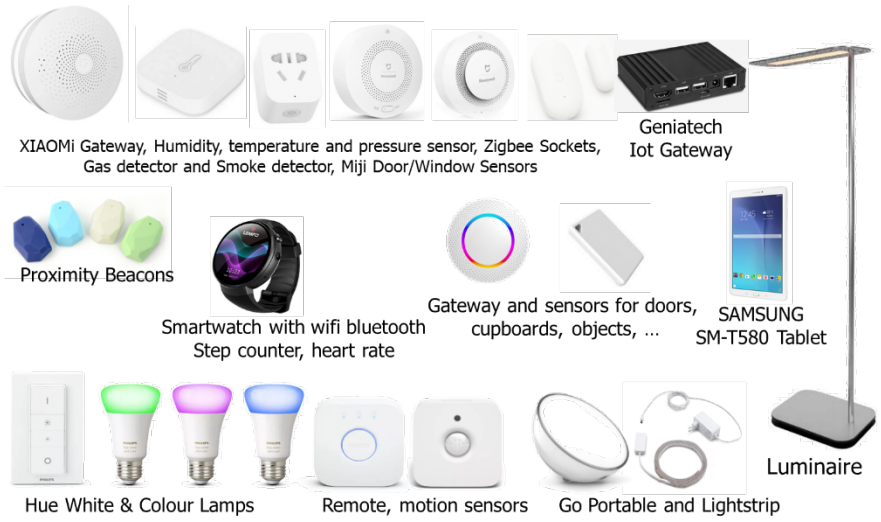

Figure 2 – Sensors and Objects in the Trials