RESEARCH-ARTICLE

Assistive Technologies for Supporting Wellbeing of Older Adults

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Published: 29 June 2021

PETRA '21: The 14th PErvasive Technologies Related to Assistive Environments Conference
June 29 - July 2, 2021
Corfu, Greece

https://doi.org/10.1145/3453892.3461352
ISBN: 9781450387927

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ABSTRACT

Over the course of the coming decades, the societal goal of maximizing the number of older adults who experience positive trajectories of ageing has been established. To this end, innovative technology-based interventions tailored to older adults' functional levels and focused on healthy lifestyles are considered imperative. The purpose of this work is to present a cluster of digital solutions aims at supporting and maintaining healthy and independent living for older adults, who face permanently or temporarily reduced functionality and capabilities.

CCS CONCEPTS

• **Human-centered computing**; • **Human computer interaction (HCI)**; • **Interaction paradigms**; • **Web-based interaction**;

KEYWORDS

older adults, healthy ageing, cognitive training, physical training, robotics

ACM Reference Format:
Ioanna Dratsiou, Oscar Villacañas, Sara Cooper, Pavlos Isaris, Manex Serras, Luis Unzueta, and Victor Fernandez-Carbajales. 2021. Assistive Technologies for Supporting Wellbeing of Older Adults. In *The 14th PErvasive Technologies Related to Assistive Environments Conference (PETRA 2021), June 29–July 02, 2021, Corfu, Greece.* ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/3453892.3461352

1 INTRODUCTION

The number of older adults worldwide is increasing and due to this increase in the population of aging, older adults face a series of health problems [1]. Sensory changes (hearing loss, presbyopia, decreased vestibular function leads to falls), weakness of muscle strength and mass, osteoarthritis, diabetes, depression, chronic obstructive pulmonary diseases, as well as changes in the physical and cognitive functions are very common in older adults [2]. Therefore, maintaining older adults' physical and cognitive function is considered of utmost importance in order to ensure healthy and active aging [3]. The apparent link between age-associated declines in physical and cognitive function [1] increases functional dependence, morbidity and mortality of older adults [4]. This necessitates the development of strategies and innovative solutions that enable the ageing population to maintain their independent living and enhance their health [5] as well as relieve an already overburdened healthcare system [1]. Information and Communication Technology (ICT) is often suggested as a means to accomplish the aforementioned support [5] and offers in response the utilization of various Assistive Technologies (AT) and digital solutions to help people live independently [6] and, subsequently, overcome problems they face in their daily lives [7]. Importantly, technology-based interventions seem to offer greater improvements and benefits compared to traditional training and rehabilitation programs in overall quality of life [8]. In this context, the H2020 SHAPES project [9], aims to support and extend healthy and independent living for older adults who are facing permanently or temporarily reduced functionality and capabilities. More specifically, it integrates a cluster of digital solutions, including assistive robots, eHealth sensors and wearables, Internet of Things (IoT)-enabled devices and mobile applications that will be deployed in a Pan-European Large-scale Pilot Campaign, involving 2.000 older adults, care givers and care service providers.

2 SHAPES PILOT ACTIVITIES

Seven pilot themes are being explored within the SHAPES Pilot Campaign, and in particular "Improving In-Home and Community-based Care" and "Psycho-social and Cognitive Stimulation Promoting Wellbeing" are discussed in this study.

2.1 LLM Care Health and Social Care Ecosystem for Cognitive and Physical training

The Integrated Healthcare System Long Lasting Memories-LLM Care [10] will be exploited within the Improving In-Home and

PETRA 2021, June 29–July 02, 2021, Corfu, Greece

ACM ISBN 978-1-4503-8792-7/21/06…$15.00
https://doi.org/10.1145/3453892.3461352

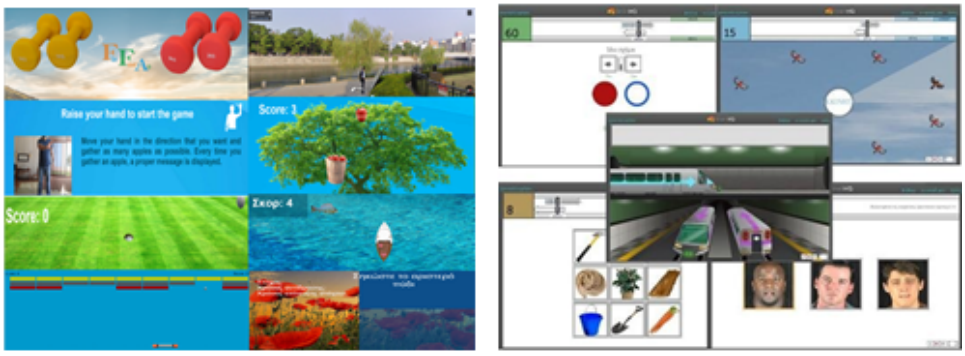

Figure 1: LLM Care

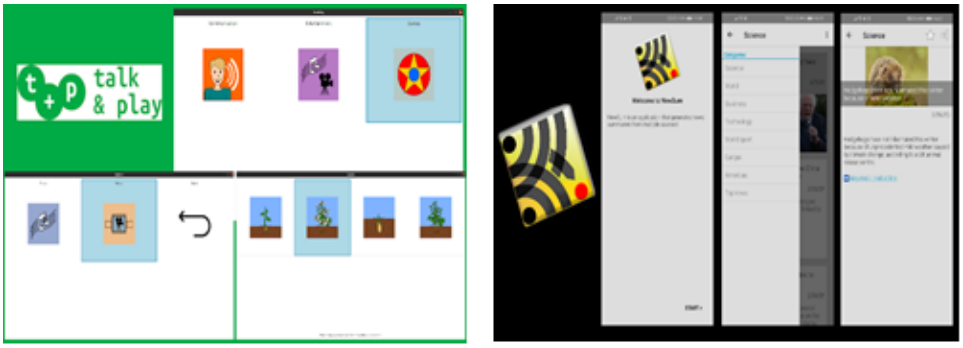

Figure 2: Talk and Play & NewSum apps

Community-based Care pilot theme. LLM Care combines state-of-the-art cognitive exercises with physical activity and offers an integrated solution for cognitive and physical health. It provides effective protection against cognitive decline and actively improves older adults' quality of life (Figure 1) [11, 12]. LLM Care will act as a holistic framework by integrating the desktop-based app Talk and Play and the mobile app NewSum [13]. Specifically, Talk and Play enhances communication and independence, through a collection of serious games aiming at cognitive training, while NewSum, exploiting Artificial Intelligence (AI), automatically facilitates the summary of news from a wide range of online resources by excluding all repeatedly presented information and demonstrating it in a unified text (Figure 2).

2.2 Cognitive tasks robot

The pilot theme Psycho-social and Cognitive Stimulation Promoting Wellbeing includes ARI, a high-performance robotic platform designed for a wide range of multimodal expressive gestures and behavior, focused on social interaction (Figure 3) [14, 15]. Based on Adilib chatbot framework and voice technology, a voice conversational assistant along with exercises DiAnoia and Memor-I [12] will be deployed in ARI in order to guide and motivate the older person during personalized cognitive training and increase motivation and engagement. ARI will incorporate an emotion recognition module that will determine different emotional states of users during interactions with the robotic system (Figure 4) [16] and a face recognition solution for heterogeneous IoT platforms, namely FACECOG (Figure 5), which allows recognizing person identities, based on privacy-preserving identity vectors (i-vectors) efficiently extracted from facial images "in-the-wild" [17].

Figure 3: PAL Robotics ARI robot

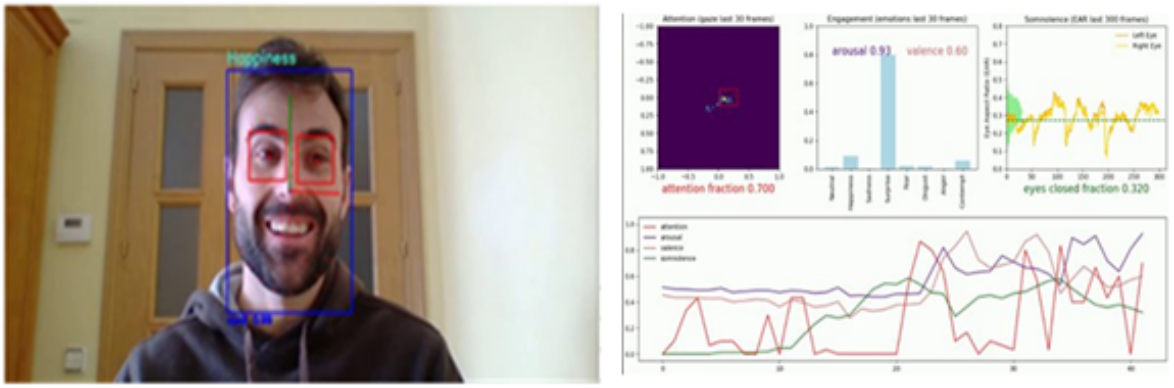

Figure 4: Sentiment analysis DS and Dashboard of User Engagement Solution

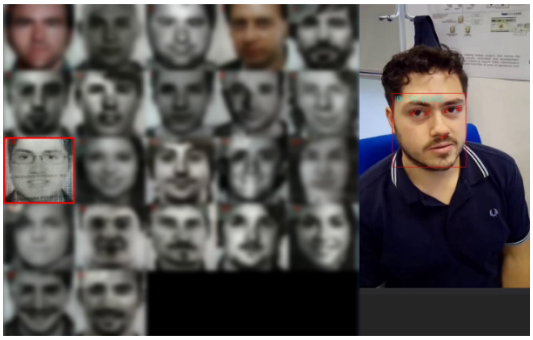

Figure 5: FACECOG - Face Recognition

3 DISCUSSION

As people enter old age, they experience numerous permanently or temporarily reduced functionality and capabilities as well as role transitions that may affect self-perception and position in their social networks [18]. To this end, the need of development and exploitation of technology-based innovative interventions tailored to older adults' functional levels and focused on healthy lifestyles are considered essential [5]. Indeed, the rapid growth on the development of healthcare-related technologies demonstrated promising beneficial effects on helping older adults maintain active and healthy ageing [19]. The aim of this study was to present a cluster of digital solutions focusing on supporting and maintaining healthy and independent living for older adults within the context of the SHAPES project. SHAPES project ambition is focused on setting the ground of long-term healthy and active ageing and maintaining a high-quality standard of older people's life in Europe by integrating a broad range of user-centered innovative digital solutions. This involves combining social-scientific and clinical research, with technological innovation to develop a sociotechnical ecosystem of people engaged in diverse activities, facilitated by SHAPES digital solutions and platform.

ACKNOWLEDGMENTS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 857159.

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