EU-RESEARCH PROJECT
DAPAS – Deploying AAL Packages at Scale
2018 - 2021

FROM DESIGN FOR CARE TO DESIGN FOR WELLBEING

Report on Lessons Learned

The DAPAS project is co-funded by the AAL Joint Programme (AAL-2017-049) and the following National Authorities and R&D programs in Austria, Bizkaia/Spain, Luxembourg and Portugal: BMK, program benefit, FFG (AT), Bizkaia (ES), Fonds National de la Recherche Luxembourg (LU) and FCT (PT).

FROM DESIGN FOR CARE TO DESIGN FOR WELLBEING:

REPORT ON LESSONS LEARNED

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1. Introduction

Demographic change is one of the key challenges for the 21st century. Europe's population has undergone a fundamental change in its age structure. Between 2015 and 2050, the proportion of the world's population over 60 years will nearly double, from 12% to 22% (see WHO, 2017). As older adults often face physical and mental health challenges in daily life, this group of people needs specific attention. Older adults are at greater risk of multiple chronic health conditions and related disabilities, falls and injuries, cognitive impairment, frailty, reduced social participation and isolation with consequences for their independence and quality of life (see Rowe & Kahn, 1997). In Europe, around 32.1% of people at the age of 65 live alone (see Eurostat, 2017).

The ageing of our society has several aspects. One aspect is the difficulties older people experience with their Activities of Daily Living (ADLs) and the organisation of their daily routines. The majority of accidents of older adults, including falls, occur in their private homes. Older adults often start to feel insecure which often leads to reduced mobility. Consequences are reduced independence and participation in daily activities as well as in the community. Therefore, technical solutions are needed to adequately support older adults in daily life, to make them feel more secure and to maintain/improve their autonomy (see Rowe & Kahn, 1997; Siegel & Dorner, 2017).

Another aspect is the image of one's own age and the needs of older people. Images of old age and ageing have never been as different as they are today. The cultural image of older adults who are needy and weak, suffering and passive, intolerant and inflexible is no longer valid. The old of today age later than the old of before. And if everyone wants to get old, nobody wants to be old today. Due to activity, interest and openness, the culturally shaped age roles, such as voluntary activities, expert activities or family-supporting functional roles, are moving further and further away from earlier role models. (see Horx, 2011) This fact requires the development of new approaches, visions and measures for how our society reacts to this change.

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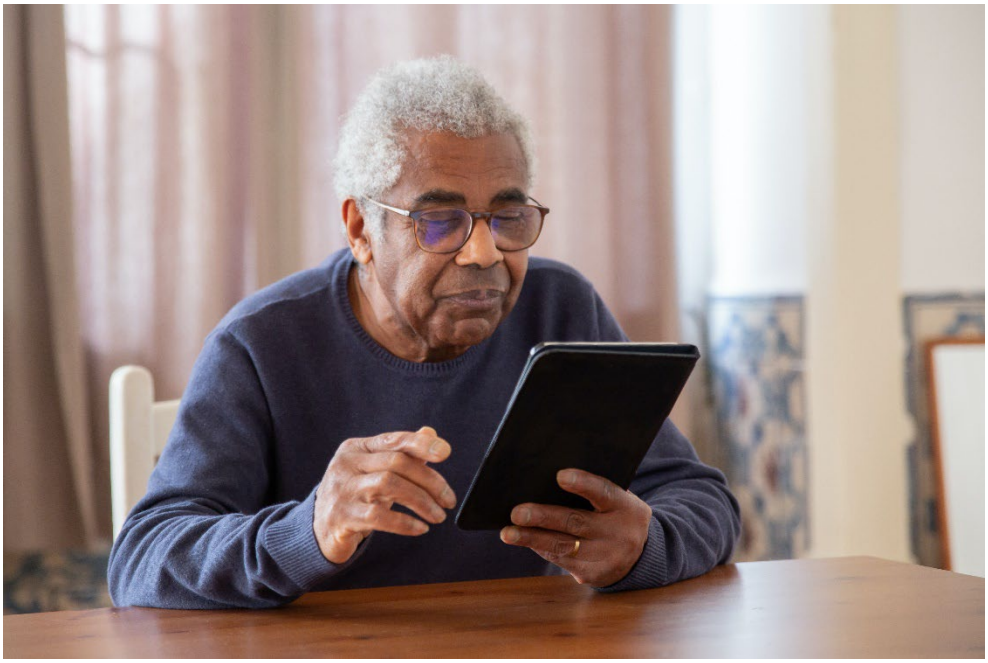
The AAL Joint Program is a research funding initiative that aims to contribute to answering the challenges posed by the demographic change. This programme supports “innovation that keeps us connected, healthy, active and happy into our old age” (AAL-Europe, 2021a) and funds research projects for the development of ICT-based technology, from systems, products to services.



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The point of view under which premises ICT-based technical solutions for the demographic change are to be developed has evolved in recent years, from the focus on the technical development process for health products to the development of holistic system solutions aimed at promoting human wellbeing. As early as 1946, the WHO described health as complete physical, mental and social wellbeing (see Blickhan, 2018, p. 15).

The factor wellbeing as a central element or key to the three levels of human health is receiving more and more attention and is being researched around the globe. The psychologist Martin Seligman (2011) advocates a paradigm shift from healing complaints and diseases to a new direction in maintaining and improving human health and the experienced subjective wellbeing. He

defines wellbeing in terms of five measurable elements: positive feeling, commitment, relationships, meaning and achievement of goals.

Photo by Teona Swift from Pexels

The interaction of these five elements results in human wellbeing. Based on the need to look for new solutions for urgently needed structural models, services and products due to demographic change, the research field *Design for Wellbeing* was promoted. But health and wellbeing are no longer topics that are discussed purely in the context of socio-technical product development for the demographic change, but have acquired a wider social dimension.

In the context of AAL applications, a big challenge that is related to the deployment is the actual distribution of technology and services to the end-users. There are numerous successful and innovative approaches to AAL solutions which all struggle the structures to scale their distribution. The AAL Joint Programme has identified that fact and stated that there is a need to focus more on exploitation and commercialization and stretch the AAL value chain to implement solutions in realistic conditions in larger scales (see Brooke, 1996).

2. The DAPAS Project

Over the past two decades, in addition to basic research, which is constantly being carried out in the field of human medicine, the focus has been on basic technical research in the context of AAL research. The results of this research work, however, found little translation into marketable product solutions. As mentioned before, the AAL Joint Programme aims to change this by funding applied research projects with the focus on exploitation and commercialization of the developed technical solutions.

The process of the distribution of AAL applications is very often performed on a case-by-case basis, which is very time and cost intensive, therefore increasing price and costs for end users and user organisations. In many cases configuration efforts are high and no plug-and-play solution is offered. This is one of the reasons why the market penetration of AAL services is still very low.

The research project DAPAS tries to solve the bottlenecks currently perceived in the area of solution distribution by focusing on scaled, easy, effective, and multi-national distribution of AAL packages.

It deals with the integration of assistive support technologies from different organisations combined with a variety of optional service packages, which are specifically tested for their suitability for daily life activities. The DAPAS system combines elements such as a communication support system, an activity tracker, serious games, different reminder possibilities and a social alarm system. With these tools, DAPAS aims to allow older adults to monitor and manage their personal wellbeing and their safety. The DAPAS system offers support and safety in everyday life, intending to facilitate communication with caregivers and relatives and to give information about the wellbeing/activity status directly provided by the older adults (see DAPAS, 2021). Furthermore, it will take into account the organisational and technical structures and framework around the packages. The (cost-) effectiveness and acceptance of the distribution process is one of the measures in the evaluation of the project.

The DAPAS solution supports older adults with need for care as primary end-users and their involved carers or medical services by focusing on the creation of a feeling of security, supporting activities of daily life and increasing the getting in contact with loved ones.

Security

A majority of accidents involving older adults occur in private homes. There is a large number of older adults living in single households and others capable of helping and assisting in critical situations are often not close. Mishaps and accidents shall be decreased and the relatives and involved carers want to know the persons they care for are safe.

Activities of daily life

There is an increasing prevalence of chronic diseases and related disabilities within the group of older adults. These often restrict the performance of Activities of Daily Living (ADL) and self-care. DAPAS helps to fulfil and manage daily tasks, to keep older adults active and independent as long as possible and is even able to communicate wellbeing/activity status to remote sites.

Communication

Isolation and social exclusion are problems often perceived by older adults. The need and wish for communication increases (especially in private single households) but relatives and friends are often remote or far away.

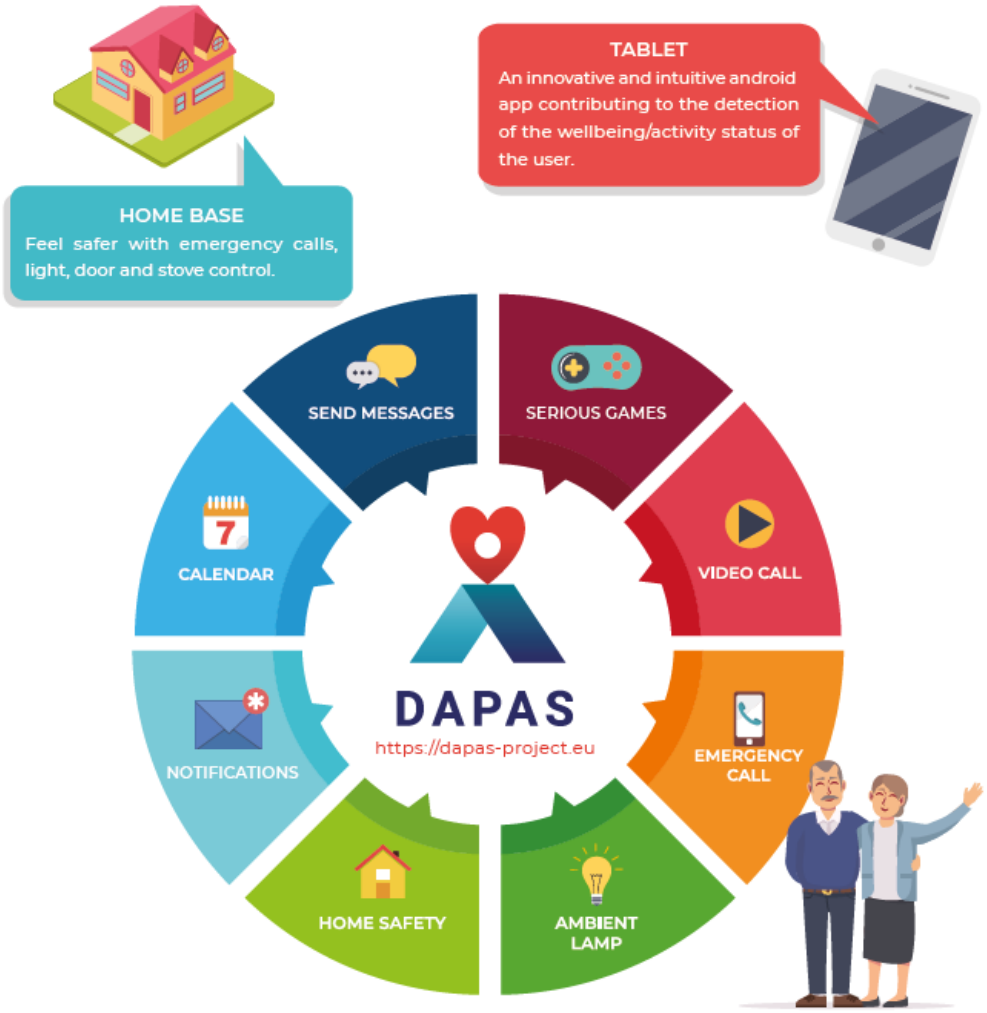

Figure 1: The DAPAS project areas.

In order to better understand the context of the research landscape, in which the project DAPAS is embedded, the following sections provide an overview of current research projects and issues relating to the improvement of human wellbeing through ICT devices or systems.

2.1. Overview of current AAL Wellbeing Projects

First, we took a closer look on other current AAL projects, which take in a comprehensive to holistic perspective on wellbeing and focus on the development and implementation of devices and applications for self-testing and self-coaching.

Current research projects primarily focus on the improvement of older adults' wellbeing by supporting them to lead a healthy, active, autonomous as well as independent life as long as possible. The developed services and products aim at a holistic health promotion considering physical, psychological and mental health as well as crucial wellbeing factors like mobility, social networks, social inclusion and security, for instance, regarding health, accessibility or home and public security.

The following selected examples provide a clearer picture of recent developed and implemented innovations including Smart Home systems, various assistive technologies and devices, applications or platforms.

To learn more about the outlined projects below, follow the links provided in the References.

Active@Home aims at promoting older adults' physical activity through multiplayer-exergames designed for larger TV-screens through HDMI dongles. The exercises are monitored by the usage of simple wearable motion sensors and guided by user-friendly virtual characters.

An avatar and robot-based personalised assistant intends to motivate older workers to a more active and healthy lifestyle as well as to convey a more positive mind-set within the project **AgeWell**. Therefore, speech recognition technologies, machine learning as well as founded psychological methods and models are used to address individual needs and preferences.

CoachMyLife focuses on the support of older people's daily activity as well as the reduction respectively stabilisation of their memory by using smartwatches and localization Bluetooth beacons to infer performed activities through machine learning. Different sensors are placed strategically

at the participants' homes; notes are displayed on a screen depending on the activity and user's profile.

The project **FRAAGILE** analyses the status of the person, physically and mentally, in terms of frailty, and offer physical and mental exercises to avoid the risk of possible falls using an accessible and affordable solution that combines videos for exercises and serious games to both train and detect physical or cognitive frailty.

By combining existing innovative AAL solutions interoperable with professional home automation systems, the "AAL ready Smart Home" system **gAALaxy** intends to support older people in staying autonomously and socially active in their familiar environment as well as to introduce them to AAL-technologies.

Within the project **Gift to Gift**, a senior-to-senior platform provides chances to connect and exchange with others for particularly older adults without a local support network. The objective is to co-create a novel collaborative economy initiative, which assists as well as activates older persons living at home.

i-evAALution combines assistive technologies with modern consumer and communication products to support older adults in their daily life by promoting their autonomy, mobility and activity as well as reducing possible worries about personal safety. The used technology includes communication tools (e.g. voice recognition), a tablet, a security system, a network-based solution for neighbourhood help as well as a smart home automation system.

The holistic oriented online platform and application **iCAN** provides services to connect with family and friends via features like smart gaming. Furthermore, a wirelessly connected smart watch measures different biometrics and dynamically informs the wearer as well as the platform and connected people (e.g., family, medical staff) of possible occurring conditions and anomalies.

Consisting of a robot, screen games and sensors, the **ReMember-Me** system captures data on the users' status and aims at engaging them in personalised brain training schemes according to their routines and preferences. Moreover, it provides a monitoring platform connecting older

people with their network of caregivers as well as a social platform connecting them with other people through exchange of experience and knowledge.

StayFitLonger provides an integrated platform for healthy ageing at home accessible through a mobile application including a virtual coach. The innovation intends to improve the cognitive and physical fitness of older people living at home as well as their interdependence by exercises linked with everyday life and a virtual coach giving feedback and cheering them on.

Within the project **TACTILE**, a mixed reality (MR) software for older adults has been developed, which addresses the risk of developing dementia by providing challenging board games, chances to interact with other people and do physical exercises on MR glasses.

The ICT platform **TURNTABLE** integrates solutions for the most pressing daily needs of older adults. It aims at supporting users to develop healthy nutritional habits through personalised dietary recommendations and guidelines as well as assisting them in sustaining a more active lifestyle involving reducing feelings of isolation, acquiring new skills or enjoying outdoor spaces.

2.2. HCI Design for Wellbeing

After obtaining an overview over current AAL wellbeing projects, we researched for recent (three years at maximum) projects focussing interface design as well as hardware design regarding human wellbeing in the ACM Digital Library, which is currently one of the largest and most used databases on HCI research on a broad basis.

Recent research projects primarily address vulnerable humans like older persons, children, and people with physical respectively cognitive impairments or diseases. They focus on physical (e.g., mobility promotion, nutrition awareness, healthy sleep) and psychological health (e.g., positive mind-set, empowerment) as well as mental wellbeing (e.g., cognitive promotion). Following a comprehensive to holistic approach, the projects aim at an integrated health promotion and prevention (e.g., physical and mental diseases, loneliness) improving particularly social interaction, social inclusion, digital wellbeing, usability and transparency.

Interventions within current research projects, such as applications for smartphones respectively tablets, intend to contribute to people's wellbeing by providing features like journals, calendars, memory tracers, games or services to connect and interact with other people. Other interventions aiming at the improvement of users' wellbeing integrate paper-journals or paper-diaries, tablets, (GPS-) trackers, virtual/augmented/mixed reality tools (e.g., headsets, haptic interfaces) respectively intelligent user interfaces such as voice user interfaces, voice assistants, (mobile) chatbots (e.g., for social media like Facebook), virtual coaches (e.g., NESTORE), robots, different wearable user interfaces (e.g., smart watches) and Smart Home systems.

In the following, we outline seven representative examples for the research areas mentioned above and thus enable insights in issues defined as relevant in current HCI research.

Following a psychological point of view, Klapperich, Laschke and Hassenzahl emphasise in their conference paper from 2018 that the goal of a wellbeing-driven approach to technology design is to **improve peoples'**

everyday lives by providing **enjoyable and meaningful experiences**. By introducing the Positive Practice Canvas (PPC) they provide a supporting tool for designers respectively developers to identify concrete opportunities for improving wellbeing through design (see Klapperich, Laschke & Hassenzahl, 2018).

The lack of psychological factors within technological interventions was discussed by Calvo and Peters in their conference paper from 2019. There, they argue that there is no systematic integration of wellbeing science into tech development and the many reported technology-induced harms to mental health attest to this deficit. Within a course, they proposed frameworks for designing technologies that **respect human values and wellbeing** by providing practical tools for ideation, design, and the evaluation of the **psychological impact** of products (see Calvo & Peters, 2019).

Besides psychological factors, social factors are crucial for technological interventions regarding human wellbeing as well. Thus, for example, McNeill's, Campbell's and Coventry's study, which aimed at engaging a group of healthy older adults in lifelogging and using their data to help design a healthy-ageing intervention, showed the relevance of specific types of **social involvement** (e.g., meeting activity-group members) and led to the conclusion that recommender systems should consider these important predictors of wellbeing (see McNeill, Campbell & Coventry, 2019).

Following a psychological as well as sociological perspective, Rodgers' et al. introduced the concept of **wellbeing-as-interaction** by presenting an early-stage work on designing technologies for people to collaboratively express, interpret, discuss and enact wellbeing through the technology probe MoodCloud, consisting of a mobile app and an ambient display to share wellbeing updates through colour (see Rodgers et al., 2019).

Following a similar comprehensive approach which includes physical user wellbeing as well, El Kamali et al. designed a virtual coach, which was presented within their conference contribution in 2020. NESTORE intends to support older adults during their journey to wellbeing by **interacting with the users** through a text-based chatbot integrated in a mobile application as well as a tangible coach (physical object based on vocal interaction and tangible interaction). The intervention aims to motivate people to take care of their

health by proposing **nutrition, physical activities and social interactions** to **preserve their wellbeing** (see El Kamali et al., 2020).

The impact of technologies on psychological health has eventually led to a growing interest in '**digital wellbeing**' and related research within HCI, as Peters and Ahmadpour discussed in their article from 2020. There, they argue that designers have to incorporate **wellbeing-supportive design knowledge** and **methods** into their practice in ways that are practical and scalable to provide technologies which better **correspond to psychological needs** (see Peters & Ahmadpour, 2020).

A stronger trend towards interdisciplinary approaches can be finally observed in recent HCI research. Thus, for example, Sas et al. outline novel, **interdisciplinary ways** to actively engage workshop participants through interactive systems, with an overall aim to shape the research agenda of future HCI work on mental wellbeing in their paper from 2020.Designed as an innovative format, it intends to bring together **practitioners as well as HCI researchers** from across a range area addressing **mental user wellbeing** (see Sas et al., 2020).

The distribution of technology and services to the end-users is one of the major challenges in AAL interventions. As mentioned above, this process is still frequently performed on a case-by-case basis which is time-consuming and costly for end-users as well as end-user organisations. DAPAS stands out from other AAL programmes by initially bringing findings and learnings from the earlier projects DALIA and RelaxedCare together to a more comprehensive solution, which was tested and long-term evaluated.

The following sections will outline the focus and process within the AAL project DAPAS, beginning with a description of the target groups.

3. Definition of Target Groups – AAL Programme

The project DAPAS has a multi-layer scheme of action that involves different stakeholders. It will depart from the AAL programme definition of users: to frame its own set of possible beneficiaries and stakeholders:

> **Primary end-user** is the person who actually is using an AAL product or service, a single individual, “the wellbeing person”. This group directly benefits from AAL by increased quality of life;
>
> **Secondary end-users** are persons or organisations directly being in contact with a primary end-user, such as formal and informal care persons, family members, friends, neighbours, care organisations and their representatives. This group benefits from AAL directly when using AAL products and services (at a primary end user’s home or remote) and indirectly when the care needs of primary end-users are reduced;
>
> **Tertiary end-users** are institutions and private or public organisations that are not directly in contact with AAL products and services, but who somehow contribute in organising, paying or enabling them. This group includes the public sector service organisers, social security systems, insurance companies. Common to these is that their benefit from AAL comes from increased efficiency and effectiveness which results in saving expenses or by not having to increase expenses in the mid and long term.” (AAL-Europe, 2021b)

3.1. Definition of Target Groups – DAPAS Project

The DAPAS project addresses three main target groups.

Primary end-users

The primary end-users are people 60+ years old, who live autonomously within their community either at home or in sheltered accommodation. Their health situation is relatively stable or is well-managed either by the older adult his/herself alone or with the support of informal and/or professional caregivers.

Secondary end-users

The secondary end-users, also called formal and informal caregivers, are people who are in direct contact with the primary end-users. They include caregivers from care organisations as well as family members, friends, neighbours and acquaintances of the older adults. Some of these people may in fact be acting as informal caregivers to the primary end-user.

Tertiary end-users

In DAPAS, the tertiary end-users are the decision makers, those that may be instrumental in the future exploitation of the product issued from the work undertaken within DAPAS. For example, executives of care providers, ministries, municipalities, health and social care insurance providers and companies who are involved in building houses for older adults.

4. Work Plan

The project comprised three iteration cycles and high emphasis on roll-out and evaluation. Phase 1 covered the refinement of the design and the integration and testing of the first version and covered the **Starter Version** and its introduction to the trials. In Phase 2 we covered the **Value Version**. Phase 3 of the project covered the integration of the final version, the **Premium Version**, with the related modules and its evaluation in field trials. The following figures show the work package structure and the interdependencies of the work packages which were agreed on by the partners at project start. The time shift had to be postponed due to the Covid-pandemic.

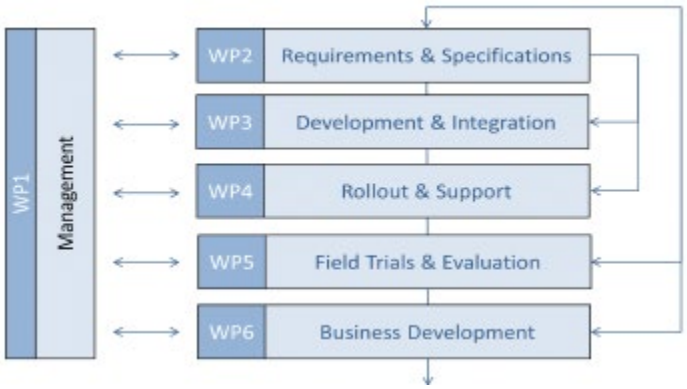

Figure 2: Work Plan.

Work Package 1 – Management

The objectives of this Work package were to handle the strategic and everyday management of the project, including financial, non-technical and administrative coordination among all activities involved in the project. Additionally, the target was to maintain seamless communication flow between the Consortium members, the AAL CMU and national funding organisations and to guarantee appropriate quality and timely delivery of reports, deliverables and project outcomes in general in order to ensure the successful termination of the project as scheduled.

Work Package 2 – Requirements and Specifications

The objective of this work package was to investigate the users' demand on interaction preferences and aesthetics in product appearance, which is a key factor for creating an emotional experience with a product or service, and to design use cases and scenarios to ensure that the system's services and products address the identified user needs and fit daily routines of the users.

Furthermore, the stakeholder versions and their functions were defined and the user stories were reviewed to meet all stakeholder requirements. Finally, a special focus was put on rollout/support requirements to meet the challenging goals of smooth rollout and to support future exploitation.

Work Package 3 - Development and Integration

In this work package, the existing solutions from Dalia, Emma, RelaxedCare, Kwido and "DEU Project" were bundled to the different editions of DAPAS. Besides the client software, the backend was unified and the rollout and support environment was developed. Subsequent internal testing activities guaranteed a stable and expandable solution. As a result we had three main iterations of the complete solution.

Work Package 4 - Rollout and Support

In this work package, we focused on the practical aspects of the large scale rollout to the end users and the subsequent support. One of the main objectives of DAPAS was a smooth, effective and reliable rollout and support phase. It is the practical application of the Tasks T2.3 (Specification) and T3.3. (Implementation) and the proof that our concepts worked under practical conditions. The required resources for this had to be allocated, as well as the evaluation of the results will be handled here.

Work package 5 - Field Trials and Evaluations

The objectives of WP5 were to prepare, implement and conduct a longitudinal, randomised, controlled, multicentre, real-life, end-user trial by the national organisations representing end-users within their countries, including a cost-effectiveness analysis of the competing interventions. Great emphasis was put on the development of a robust trial concept which will guide the recruitment of the test candidates and the control candidates, actual trials and enable a sound evaluation. The trials run from M16 - M38 and it was expected that each candidate would test the system for a minimum of one year. The first participant of the trial was enrolled in Austria on the 10th of December 2019.

During the trials, the end-user organisations ensured the smooth running of the trials and gave technical support as need be. Technical information was passed on to the technical partners as required to perfect the prototype.

Assessments were initially performed at baseline and repeated whenever changing from one DAPAS version. The end-user organisation was guided and supported by MUV who undertook the coordination of the research elements of the trails.

Work package 6 - Business Development

The outputs included

- obtaining a viable business model and commercialisation plan
- widely disseminating the project's results to create public awareness and get in touch with various stakeholders
- testing the business model and evaluate further exploitation
- preparing later market launch

5. Ethics

The consortium acted in full compliance with well-established ethical frameworks, namely regarding justice, equality of access and choice. All data collected, shared and analysed during the project strictly followed the European legal and ethical regulations.

The trial was conducted after approval by local/national ethical review committees. Eligible people were informed about the purpose and procedures of the study and gave their oral and written informed consents.

The selection of participants was carefully developed by the care organisations in compliance with ethical practises already in place. The project did not recruit people affected by severe cognitive, affective and neurodegenerative disorders; therefore, participants were able to give voluntary informed consent. They were enrolled on a voluntary basis, without any sort of discrimination, apart from the fixed inclusion/exclusion criteria. Every participant received a detailed verbal explanation and a sheet containing information about who will be the researchers, sources of the funding, aims/purpose of the study, research procedures, expected risks/discomfort, who will benefit from the study, how findings will be disseminated. Furthermore, they were briefed about steps taken to protect the privacy and confidentiality of the data and who to contact in case of inquiry and when. The teach–back methodology was applied to reassure understanding of the contents.

All persons were informed that participation is voluntary, consent can be refused, withdrawal is possible at any time and, if the research activities will change, the consent will be renegotiated. A copy of the informed consent was given to the participant and the original signed consent document was retained in the study records. The research did not require invasive techniques nor collection of biological samples. Researchers respected and protected the dignity, rights and welfare of research participants.

User Advisory Board

The project created an User Advisory Board (UAB) that included one representative of each trial site, two selected external experts to be invited and two older persons. The external experts brought external experience to the project and helped to better shape user requirements beyond the use cases directly addressed within the project. The older adults were informed in detail about the project and their opinion was taken into account in decisions to be taken. They also helped to draft information material for end-users to facilitate recruitment and dissemination of results, participated in drafting articles for the project newsletter, project leaflets and publications. The UAB also ensured that Ethical management was applied and decided on any ethical issues raised during the project implementation.

6. DAPAS System Development – Co-Creation

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The development process of the DAPAS system was based on identified stakeholder needs and requirements. It was applied to ensure the inclusion of all possible stakeholders in the development process. Thereby, it was essential that the process was centred on the user's participation but also that it evolved from this paradigm to include experts, industry, procurers, developers, authorities, NGOs, and other relevant stakeholders participating together in the different phases of requirements, development, validation and implementation.

"Coproduction is about more than good participation and/or engagement. It is a values-led approach which is characterised by inclusive processes (such as really good participation) and a wide range of practical activities that bring together different voices and perspectives on a common issue or problem – a shared agenda – in order to achieve positive change at different levels.". Besides the involvement of the whole chain of stakeholders in the ecosystem already referred in the previous paragraph (NDTi, 2013), DAPAS ensured that the following principles recommended by the NDTi would apply:

- Older people are involved throughout the project – from beginning to the end
- Older people will be made to feel safe to speak up and are listened to
- The project partners will work on the issues that are referred as important by older people
- The decision making process is clear and transparent and involves older people (User Advisory Board as defined within the DAPAS Consortium Agreement)
- Older people's skills and experience are used in the process of change
- Meetings, materials and venues are accessible for older and disabled people

From the end-user's point of view, it was interesting as well to demonstrate how participant feedback had been implemented in the system.

7. DAPAS System Versions: Starter, Value & Premium

DAPAS provides a solution for people with and without need for support care as primary end-users and their involved carers. The DAPAS system, which includes a starter, value and premium version, can be expanded according to individual needs.

hardware / version	***starter***	***value***	***premium***
android app with cloud backend			
base home automation incl. voice assistance			
ambient lamp			
home sensing/safety			

Figure 3: Three modular versions.

With the expandable set of the three system versions DAPAS supports three main areas of daily living:

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Create a sense of security for people with need for support and their involved carers. The majority of accidents involving older adults occur around 90 prevent in the home. These mishaps could be avoided with simple measures. DAPAS included home safety features to avoid accidents in the homes of older adults. Involved carers were included in the process. The aim was to promote the independence of the older adult and to give a feeling of security to the older adult and the involved carers. Hence, the stress of involved carers was clearly reduced.

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DAPAS supports people with need for support in daily living. Many older adults experience problems in daily living because of chronic illnesses or disabilities. Those difficulties restrict their ability to perform self-care. Problems in doing daily living tasks arise for many reasons and are closely linked to other health problems. DAPAS helped to maintain the older adult functions as independently as possible so that people with need for support care can stay at their homes as long as possible. Additionally, DAPAS improved the organisation of daily life through reminder functions. DAPAS

detected the wellbeing and vital values. This wellbeing detection allowed people with need for support care and their involved carers to exchange their wellbeing and communicate with each other. DAPAS helped manage the daily task and organise exercises. This management could avoid the mental stress for people in need of care and their involved carers. DAPAS supported the mental health for people in need of care with mental exercises and by doing memory work. With these features, DAPAS wanted to enable people with need for supportive care to stay active at their homes.

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Increase communication. Older adults – people with need for support usually have more time and fewer tasks than before. Therefore, communication in older age has a high priority. The need for communication is increasing but often there exists a distance between their communication partner (daughter, son, grandchildren...) and it requires suitable means of communication. DAPAS included collaboration features to offer more opportunities to exchange. These measures promoted participation and social integration of older adults in daily life.

7.1. DAPAS - System Components

DAPAS was constructed as a tablet Android app with a cloud backend and included smart hardware components.

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- **android app** – [KWIDO] [RelaxedCare] [DALIA] [Emma] [DEU]

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- **cloud backend** – [Emma] with API or Source integration with [KWIDO cloud] and [RelaxedCare]; [Emma] provided user management, IoT gateway, Messenger Integration and data collection and integration for wellbeing/activity status; [RelaxedCare] fused the data point for wellbeing/activity status; [KWIDO cloud] provided backend functionalities for questionnaires, medication reminder, alerts about daily tasks.

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- **base home automation incl. voice assistance** – [Emma] the base home automation relied technically on a microcomputer which could act as sensor and actor gateway and interact with the android app (like for medication reminder [KWIDO], emergency call [DALIA/Emma], notifications [Emma], wellbeing/activity status [RelaxedCare]) in the user's households. The functions integrated the base home automation with the cloud backend [Emma]. The home functions are listed below. It also included voice assistance [Emma].

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- **ambient lamp** - [hardware] used for notification of different functions and status visualisation; off the shelf component compatible with base home automation. Was integrated via the Emma platform (be switched on/off, can change colour and light intensity).

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- **home sensing/safety** - “off-the-shelf” sensors used for the function of wellbeing/activity status [RelaxedCare], smart home / safety function [Emma].

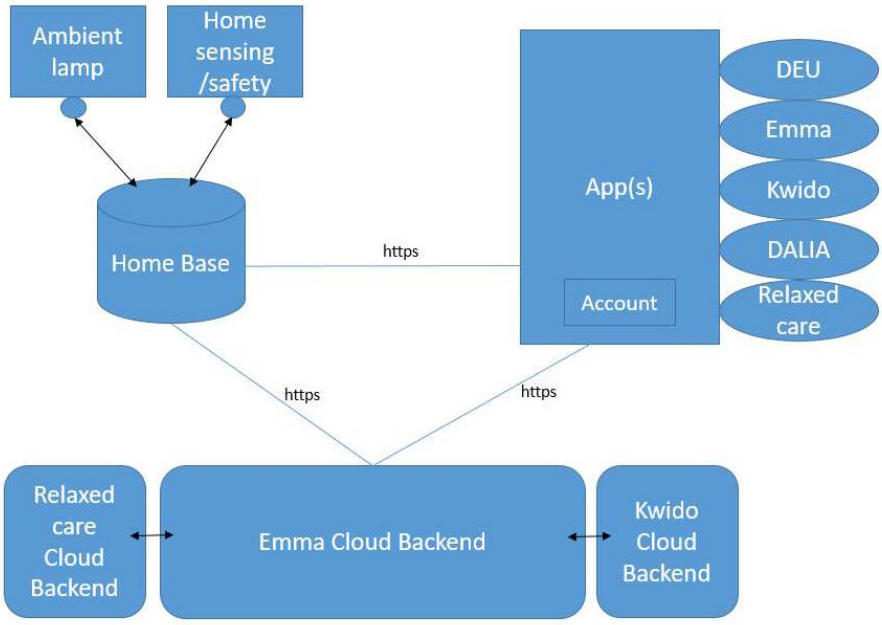

Figure 4: Draft Architecture.

7.2. DAPAS – System Functions

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- **Wellbeing/activity status** [RelaxedCare] - contributed to the detection of the wellbeing/activity status of the user. Therefore, they are asked daily how they are doing. The app responds to this when it is too bad with "contact a relative" [Emma].
    - **Dynamic questionnaires** [APP-AIT] – simple questions for older adults about their mental and physical status. The app did not respond to the users, but the data was used for evaluations.
    - **Manual status setting and easy communication** [RelaxedCare] of the status with via tablet app (Starter and Value Version) or with the integrated external buttons (in Premium Version) – e.g. “I am feeling fine today”, “I wish to be called”, “I am thinking of you” – could use the home automation - Voice assistance [Emma].
    - **Wellbeing/activity detection based app/service usage** [RelaxedCare] – by a logging of app/service – e.g. frequency of video calls, etc.

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- **Emergency call** [DALIA/Emma] – supported triggering an emergency call in situations where help is needed. The call could be routed to an involved carer or an emergency call provider. It could be triggered for example with a panic button or with speech. The ambient lamp was used as a visual sign to use the emergency call. Could use the home automation - Voice assistance [Emma]

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- **Light control** [Emma] – implemented for notifications / reminders.

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- **Video call** [KWIDO] - an easy exchange with family, friends and involved carer.

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- **Send messages** [KWIDO] – message exchange with family, friends and involved carer

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- **Calendar** [KWIDO] - was used as a shared planning aid for appointments (e.g. doctor visit) and exercises. Notifications were used with ambient lamp.

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- **Serious games** [KWIDO] [APP-DEU] – were used to train mental fitness of older adults and receive information about mood and motivation. This allowed enriching the wellbeing/activity status.

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- **Medication reminder** [KWIDO] [Emma] – reminder of medication. When a reminder occurs, the ambient lamp also lights up.

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- **Activity Tracker** [DAPAS] - was used to track daily steps (activity) and the participant's pulse (stress level). The trackers were not used in Portugal.

The functions on DAPAS were tested with the participants depending on national regulations.

7.3. Functions concerning - Wellbeing of the End-Users through the use of Home Sensors

DAPAS included the idea of wellbeing detection and status visualisation initially provided by RelaxedCare in a modified/adapted way. Wellbeing was not understood as a clearly defined socio-psychological concept here but much more as the idea that the older adult is fine at home (relieving care stress for informal carers). Wellbeing (which includes ADL and activity) detection and status visualisation were performed on different levels of complexity related to the planned DAPAS versions; (off-the-shelf) home sensors and data coming from actuators (e.g. light control) were used in DAPAS Premium:

- **DAPAS - Starter Version (use of home sensors)**

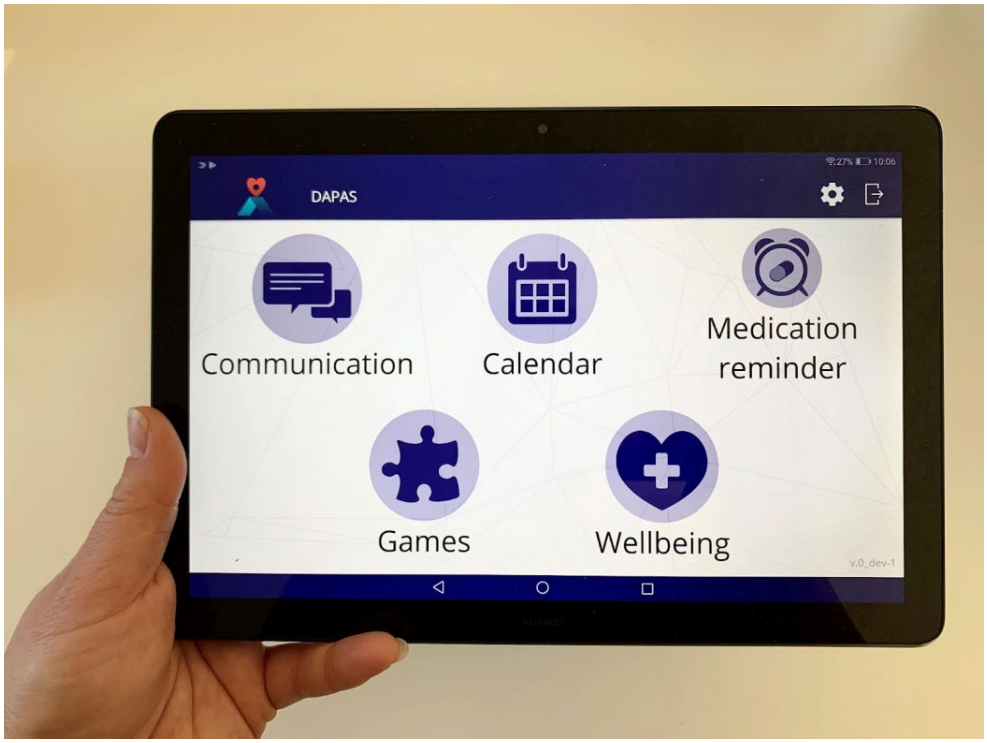

Figure 5: Screen shot of DAPAS Starter Version in English.

A simple wellbeing status was only implemented by a manual or triggered setting/input by the older adult. The client tablet app implemented graphical

user interface (GUI) elements for manual setting of the wellbeing status. Furthermore, this was enriched/fused with information coming from triggered/random questions (dynamic questionnaire) about the current wellbeing status (with optional answers like for wellbeing (fine, average, bad) or the current mood (happy, neither sad nor happy, sad).

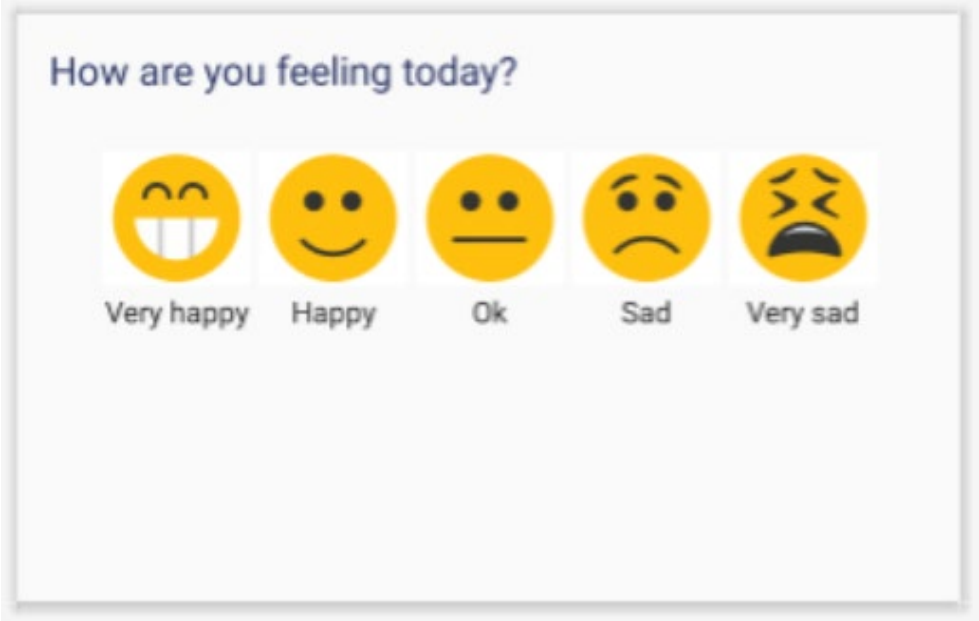

Figure 6: Mood status in English.

The choice of images and their on-screen layout was made in co-design with older people. End-user organisations realised that older people, because they were not used to technology, did not understand what emoji mean. So, co-creation sessions were made, in that opportunity, the end-users chose the emoji that made the most sense and indicated the need to have written down what the feeling means. The starting order from the happiest to the saddest (see Fig. 6) was also suggested by end-users.

- *Hardware included in version:* tablet
- *Displaying of the wellbeing status on the client side:* tablet only
- *Displaying of the wellbeing status on the remote/carer side*: on the remote side the status was displayed in an Android app running on the smartphone of the informal/formal carer.

Figure 7: Screen shots of DAPAS Starter Version in English: features of calendar, medication reminder and wellbeign status.

- **DAPAS - Value Version (use of home sensors)**

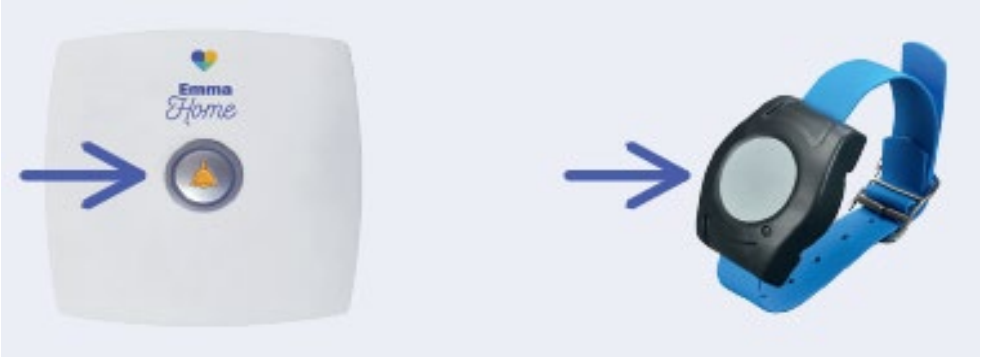

Figure 8: DAPAS Value Version: base station EMMA including emergency call for support in everyday life, to increase security and to maintain independence.

Figure 9: DAPAS Value Version: As part of the base station, Echo Dot is the external voice control.

Figure 10: DAPAS Value Version: new communication features for pictures and videos.

In the Value Version, the approach from the Starter Version was enriched / fused with data coming from app/service usage. E.g. if the person regularly used video conferencing to get connected with relatives and friends, the wellbeing - social inclusion - seemed to be ok. The basis was a service usage logging function on the tablet.

- *Hardware included in version:* tablet, ambient lamp, Emma*Home* base station
- *Displaying of the wellbeing status on the client side*: tablet and/or ambient lamp (which might be a stylish off-the-shelf lamp which can change its colour and light intensity)
- *Displaying of the wellbeing status on the remote/carer side*: on the remote side the status was displayed in an Android app running on the smartphone of the informal/formal carer.

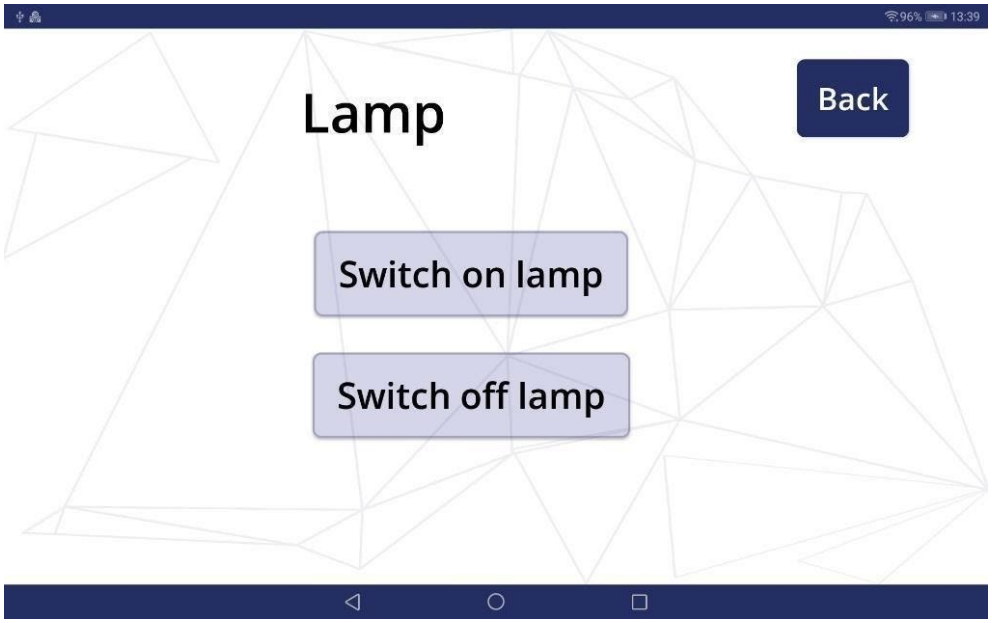

Figure 11: DAPAS Value Version: new feature to switch the lamp on or off by voice or by the tablet..

Figure 12: DAPAS Value Version: motion sensor installed in homes.

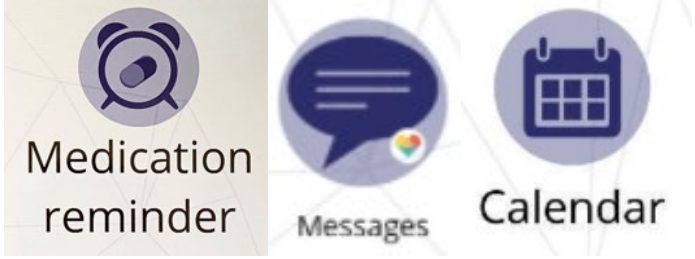

Figure 13: New voice control functions on DAPAS Value Version.

In order to expand the offer of serious games, seen as tools for the cognitive training of older people, from the Starter Version, two new games have been added in the Value Version: Cubbie (see Fig. 14) and UnlockIt (see Fig. 15).

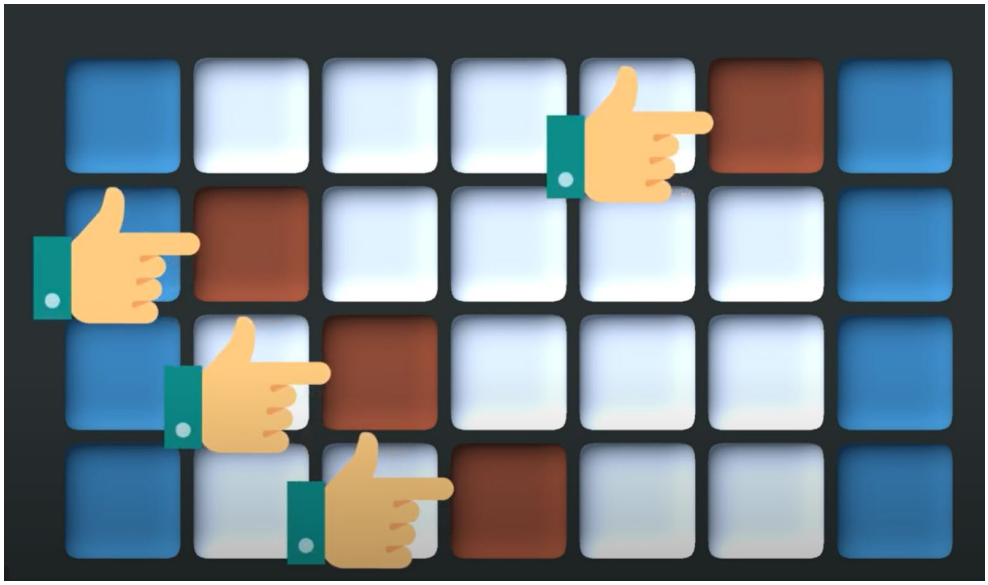

Figure 14: Screenshot of Cubbie's game tutorial.

Cubbie is a maze game where users have to find a path between sides avoiding obstacles, or select obstacles, as seen above, taking into account that these are shown just for a short period of time. The objective of this game is to stimulate memory, thinking speed and problem solving capabilities, while having fun playing.

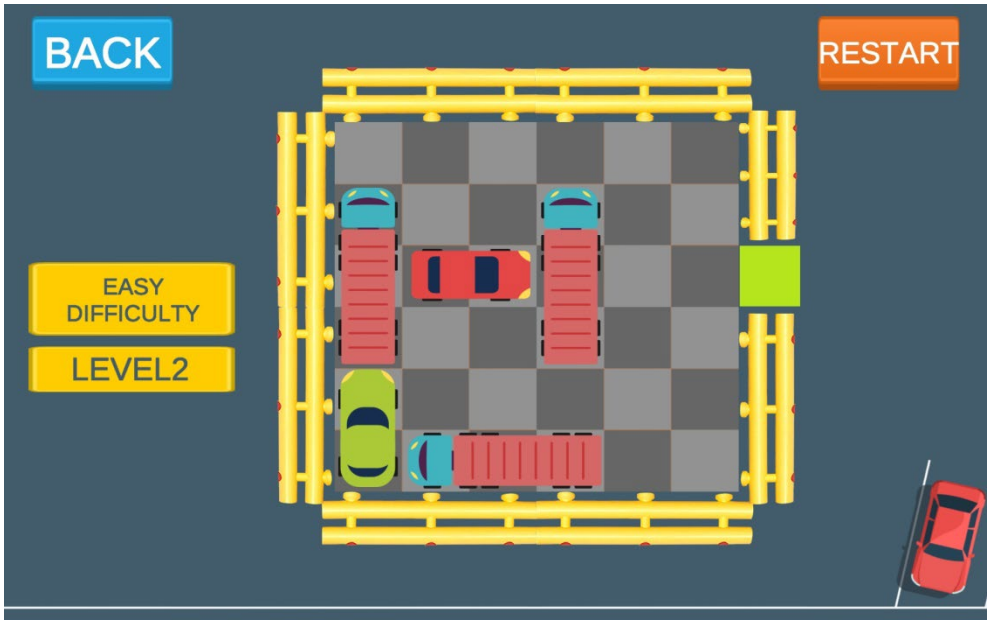

Figure 15: Screenshot of UnlockIt while playing an easy level.

UnlockIt is a sliding piece puzzle, in which the objective is to free the path between the red car and the exit of the parking, as it can be seen above. The objective of this game is the cognitive training of the player, specifically working on the visual intelligence, problem solving capacity, logical reasoning and thinking speed.

- **DAPAS - Premium Version (use of home sensors)**

Figure 16: New functions on the tablet with DAPAS Premium Version: tasks (e.g., create daily reminder, sending messages to caregivers), music feature, news feature.

Figure 17: New app features on DAPAS Premium Version: Garmin Fitness Tracker to track important fitness values.

In the Premium Version sensor data coming in from additional sensors/actors (integrated via the Emma platform) was additionally taken into account for the wellbeing detection and fused with the former versions. The domains of interest were in-house activity based on motion/presence detection and device usage. The underlying sensors consisted of motion/presence sensors (e.g. PIRs, but a motion-sensing wristband could be integrated as well).

- *Hardware included in version*: tablet, base home automation with additional sensors for activity/ADL recognition (includes home safety sensing), ambient lamp, Emma*Home* base station
- *Displaying of the wellbeing status on the client side*: tablet and/or ambient lamp and/or Emma*Home* base station (voice output)

As the games included in the previous versions of DAPAS, the objective of the new game Colorie (see Fig. 18) was to exercise different capabilities of the brain, in order to maintain or improve the mental health of older people.

Figure 18: Screenshots of the new game feature Colorie.

There was also a new feature for sharing music with others added in the Android app. IPhone does not let the users share music outside iTunes. Another feature was for sharing news with others from the smartphone app with the tablet. Apart from that, the tablet also included a feature to create recurring events (see Fig. 19).

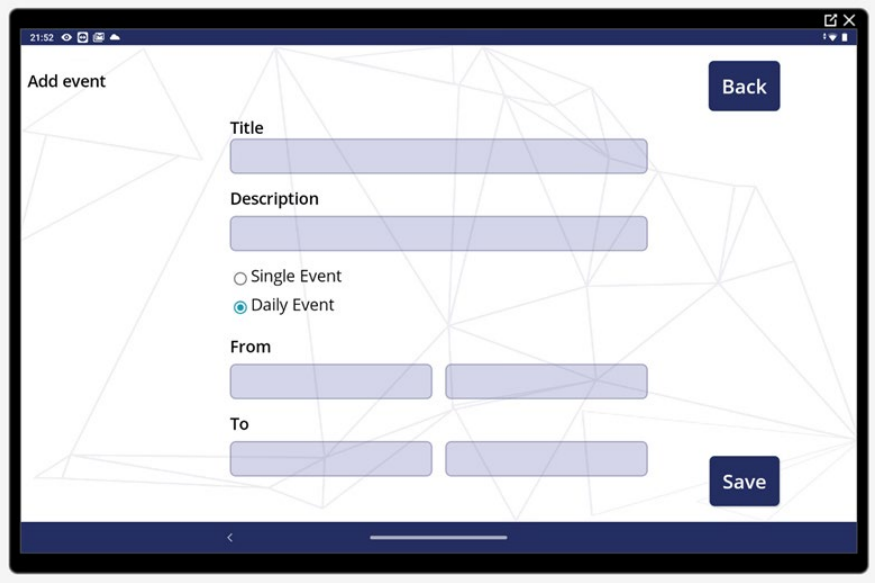

Figure 19: Screenshot of feature for creating recurring events.

Apart from that, the Calendar now offered a daily, weekly and monthly view (see Fig. 20).

Figure 20: Screenshot of adapted calendar feature.

Emma provided the pluggable, open, and extendable framework for integration, complementing the features of DALIA, RelaxedCare, Kwido and Services of DEU with Smart Home integration by adding an integration layer with of “off-the-shelf” sensors that was used for wellbeing/activity detection. Emma as well integrated the smart home component for status visualisation (i.e. the ambient lamp).

8. Project Process

Figure 21: DAPAS Starter Version © Red Cross Styria.

DAPAS comprised three project phases between 2018 and 2021, including activities built on each other.

Figure 22: DAPAS Kick-off Meeting in Graz, Austria © Exthex.

The main goal for the first year was the organisation and coordination of the project flow. Thereby the infrastructure has been built up and involved a Mailing List, a shared space for files and a concept for development tools. Another goal was working out the main features for DAPAS and the stakeholder. Within 2018, the first installations of the Pre-Version were set up. Older adults gave their valuable input throughout this project phase.

Figure 23: DAPAS promotion © Cáritas Coimbra.

During the first year, the project team also started to work out the business models for the involved consortium partners and promoted DAPAS by creating a webpage and a project fact sheet.

Figure 24: Screen shot of DAPAS project website.

Figure 25: DAPAS project fact sheet.

The consortium created some press information and did dissemination activities during some fair events as well.

The main goals for 2019 were to plan the procedure of the trial and prepare all relevant documents for it as well as to complete the DAPAS Starter Version and to integrate all inputs from the end-user organisation to adapt this first version as much as possible to the needs of the users (e.g., regarding the reminders, trackers respectively wearables).

Figure 26: Checking out the new technology, sceptical or curious? - DAPAS Starter Version © Red Cross Styria.

In order to organise the work and prepare the beginning of the trial starts, the consortium met in Bilbao, Spain.

Figure 27: First DAPAS Consortium Meeting in Bilbao, Spain © Exthex.

The first User Advisory Board meeting happened, putting together field trial sites, end-users and experts to discuss the fact sheets, documents created for the trials and informed consent. With these documents ready, the trial sites could ask for their ethical approval, in nationals Ethical Committees.

Moreover, it was agreed to have two games in the Starter Version as well as to include further games though the version changes. In addition to the website, a Facebook page and a LinkedIn page were also created to further expand the media reach. Since the establishment of these two media channels, new content has been created continuously.

Figure 28: DAPAS AAL Forum 2019 in Aarhus, Denmark © Cáritas Coimbra.

Furthermore, other press information and dissemination activities were done. Besides the media channels, the consortium members managed to participate in several dissemination activities including conferences, fairs, speeches and presentations.

Figure 29: Recruitment of study participants © Cáritas Coimbra.

After receiving the positive ethical votes, the pilot sites started recruiting the study participants in autumn 2019. After randomisation, the first installations of the DAPAS Starter Version took place.

Figure 30: Going deep into detail - DAPAS Rollout Starter Version © Red Cross Styria.

The third year, 2020, was strongly impacted by the COVID-19 pandemic. Thus, the completion of the recruitment and installation processes within the proposed time frame was delayed considerably. As will be explained better in the next chapter, the trial sites had to deal with some challenges and adapt the installation procedure and contact with participants to not put their health at risk.

Due to all the effort of the project team, as well as the formal caregivers, by 27th of November 2020, 120 older persons were included in the trial to evaluate the DAPAS system.

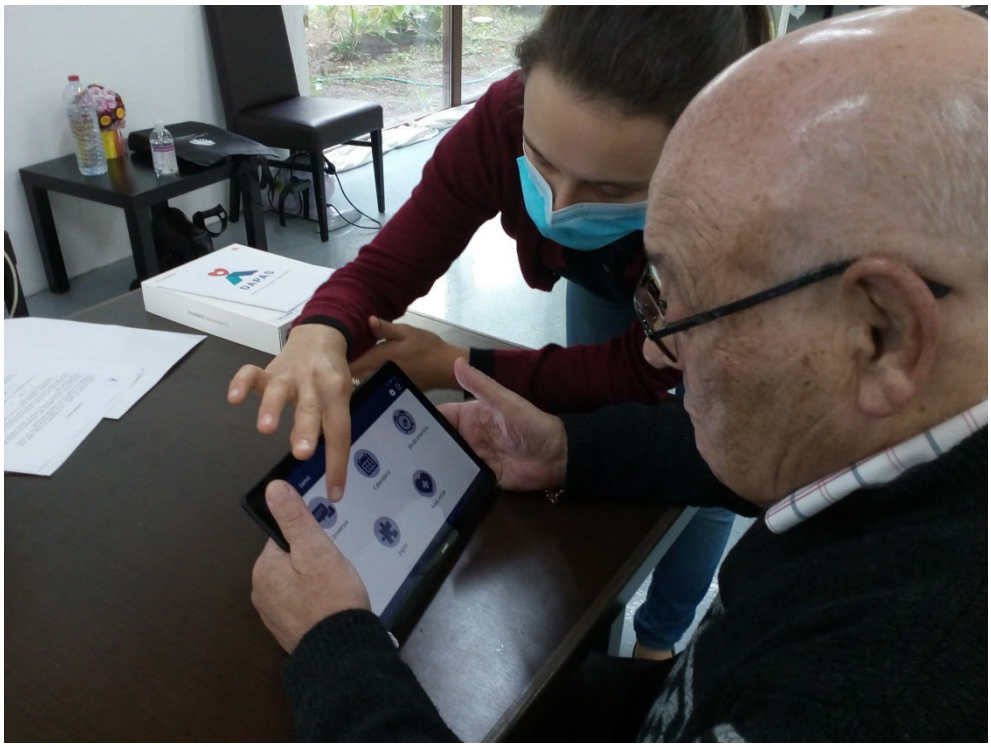

Figure 31: DAPAS Starter Version © Cáritas Coimbra.

The trial included the installation and test of the three versions (Starter-, Value- and Premium Version) for at least twelve months in total (two months per version at a minimum). The trial was extended until the end of October 2021 and the analysis was finalised by the end of December 2021.

The focus and main goals of 2020 can be shortly described as the following:

Firstly, it was essential to recruit 120 older adults to participate in the trial. As mentioned above, all end user organisations were able to require the needed numbers of participants throughout 2020.

Figure 32: DAPAS Value Version © Cáritas Coimbra.

The second main goal was to develop the DAPAS Value Version based on the feedback of the users and others as well as the distribution of the new hardware to the participants.

Along with that, the project also focused on a great support for the end users and formal caregivers. So they were able to distribute the Value Version in a great manner. Moreover, the project team put a constant effort into the support system, in order to solve small technical issues coming up during Value Version installations throughout the last months of 2020 and at the beginning of 2021.

Figure 33: Group dynamics bringing joy for end users while losing fear from new technology - DAPAS Rollout Value Version © Red Cross Styria.

Thirdly, another main goal of 2020 was to conquer the problem of several lockdowns throughout the year in the different countries and adapt the way of installations and communication with the trial participants.

Figure 34: DAPAS Premium Version © Red Cross Styria.

The year 2020 was strongly impacted by the COVID-19 pandemic as personal contacts with older adults had to be reduced in the whole of Europe.

With April and May 2020, it became easier to reach the target group in some regions, for example the Austrian participants were now using tablets regularly. In Luxembourg, the installations for all participants who should use the DAPAS system were finally installed. In summer 2020, the installation could start in Portugal.

Figure 35: Installation of DAPAS Value Version © Cáritas Coimbra.

During all lockdown the consortium continued to work on translations and technical issues for the Value Version. Furthermore, the games were finalised and sent out for testing. CDC and Exthex put a great effort into making Emma box into Portuguese. RCS also conducted an interview with a relative of a person who used DAPAS.

The project team agreed on a manual to help the end-users to install the Versions on their own, accompanied by a questionnaire about the installation process for the installation usability. To facilitate the installation of different hardware and get the users used to technology, CDC made a video, as a manual, explaining the equipment and their functions. They used a formal caregiver that used a friendly language to help users to install the second version by themselves. Moreover, a new version of APP for iOS (available for the project), a new part of the calendar as well as the Hardware for the Value Version was developed.

By November and December 2020, the (first) Value Versions were installed in Portuguese and Luxembourgish households. Moreover, control groups were contacted. In order to create content and integrate the control group in the project, CDC team created some educational books, with puzzles and crosswords, and guidance to a healthier life.

With 2021, Alexas were installed together with the Value Version, so the End User Organisation and responsible people at site had it easier to install the systems. Furthermore, the project team responsible worked on the Premium Version as well as manuals and videos for the installation.

In February 2021, the Garmin Trackers for Austria were ordered and the working on the Premium Version's wellbeing index started. Occurred challenges as well as findings will be presented in the final publication.

In March 2021, the responsible partners finalised the Premium Version, its manual and the optional door lock connection (NUKI). New challenges occurred as the features for Portugal and Luxembourg, the fitness trackers (not allowed) and NUKI connection (not possible), could not be used. It was decided that the users not using the activity tracker should also get the wellbeing-questions (without parameters measured by the fitness tracker).

In April 2021, more Value Versions were installed and activity trackers sent to the participants. By May, all users were using the Value Version for at least two months. The last Premium Versions were installed by end of August 2021. To engage participants in using the system. CDC promoted digital literacy sessions with the participants. The team made a presentation and manuals, and passed days with users talking about the DAPAS system and helping them to use it.

In June 2021, the DAPAS project was recognized by the United Nations as SDG good practice. More than 700 proposals were evaluated by a team of experts from UN (United Nations) entities and DAPAS was selected and framed within SDG 3 - Health and well-being: ensure healthy lives and promote well-being for all at all ages.

Due to COVID-19, the sessions on general health and wellbeing that were planned for the control groups could not take place as initially planned and needed adaptation (detailed described in the next chapter). At the end of 2021, the consortium meeting took place in Coimbra, Portugal. On this occasion, the partners discussed the final challenges and tasks to be completed to close the project.

Also, IDE attended the European Week of Active and Healthy Ageing 2021 and participated with EXT in the preparation of the final version of the business plan and the definition of the D6.1 IPR Inventory and Concept (Exploitation).

Figure 36: Happy Faces after successful Rollout of DAPAS Starter Version © Red Cross Styria.

9. Impact of COVID-19 Pandemic on the Project Progress

Photo by Anna Shvets from Pexels

In general, COVID-19 changed the plan considerably in regards to field trials, since social distancing was mandatory. Due to the lockdowns in the partner countries, the installations of DAPAS versions had to be paused in certain regions by spring 2020. The partners partly had to reduce all their interactions to essential activities (i.e. care related activities). For example in Luxembourg, this led to the limitation of interaction with and support of end-users only by phone till November 2020, when the installations of the Starter Versions (with respect to COVID-19 hygiene rules) could be finally continued.

Besides the challenges regarding the DAPAS versions, planned group training could not take place in project regions, which is considered an important multiplier in terms of motivation and project success. In Luxembourg, the older adults in the control group received written information about healthy ageing and had a conversation about that topic with the person who was administering the CRF instead of the planned activities (an informal social activity where the participants would have received written and oral information about healthy ageing) had to be cancelled due to the restrictions linked to COVID-19. In Portugal, the activities with the control group also had to be changed, the DAPAS team created educational books that could be delivered by the formal caregivers, and the participants felt included in the project.

In Austria, it was planned to invite the members of the control group to meetings with coffee and cake and to inform them about health-promoting topics, as it was done at the beginning of the trial (see Fig. 26). Unfortunately, this was no longer possible due to the restrictions imposed by the pandemic. Therefore the end user organisation stayed in contact via phone during the lockdown in order to support the control group during these challenging times. Hence, more time was planned by RCS for the questionnaires (via phone or personal contact), since people obviously had the need for more social contact during or after the lockdown phases. The person who made the Case Report Form (CRF) was also able to increase the safety of some of the participants in the control group by recommending the installation of the emergency call or by giving other advices about healthy ageing. Furthermore, different holiday wishes and additional advice to stay healthy were distributed via written communication to all members of the control group.

Despite all efforts on the part of the end-user organisations and the project members responsible for the trial at the centres, many end users in the partner regions could not receive the assistance they would have needed during the project. This included the troubleshooting of technical problems, problems with usability of the system and motivation to use the system at all. This led to the fact that some end-users resisted to use the DAPAS system, since they just lost their motivation and drive due to the lack of personal contact and support and hence also did not report bugs.

Many end-users reported that there was a need for exchanging information and experiences on the DAPAS system. Therefore, the Austrian team notes that with the group dynamic the motivation to use and explore the system would have been higher. As an alternative to face-to-face meetings, support via telephone was arranged in Austria and Portugal as well. But this form of communication was not quite successful and could not substitute personal communication, since social and direct communication was missing in this format.

Due to this, the project success in the partner regions relied significantly on the individual support and abilities of the formal caregiver within the assisted living facility, which also reflects the challenges of supporting end-users in individual living atmospheres.

Moreover, older adults were very much engaged with topics related to the pandemic and did not want to deal with other things, including the project. This was also one reason for the increased number of drop-outs during the projects (e.g. decline of health status).

Considering the positive side of DAPAS in relation to the COVID-19 pandemic, it was very beneficial for end-users to have a possibility of video communication in order to stay in contact with their loved ones during lockdown. They had e.g. the unique possibility to see pictures and live videos of their new-born grandkids which would not have been possible without the DAPAS system that easily. Furthermore, many people reported that they felt less lonely with the Emma system asking questions regularly e.g. “how are you, can I do something for you?” CDC formal caregivers also mentioned the huge importance of the project during the lockdown periods. Using the system, they could stay in touch with end-users and be sure they were ok.

Also, the possibility of keeping the users active with cognitive games was a beneficial point for the older adults' mental health.

Another important finding is that especially due to the pandemic, the high importance of social interactions became visible, especially for older adults.

10. Results

Photo by iStock by Getty Images

By the end of November 2020, a total of 120 older adults were included in the DAPAS study. After randomisation, carried out by the Medical University of Vienna, the DAPAS system was installed in the homes of 78 people, and 42 people were assigned to the control group. At the end of the trial, the DAPAS users reported fewer problems with using the new technology, although the versions included more features and became more complex. Between the first installation time and 31st of October 2021, the DAPAS system was used on average per person per week 7.6 times (weekly usage in sessions per user per week). Our analysis showed no improvement in the performance of Activities of Daily Living (ADLs) after 12 months in either group, but an increase in technology use especially in the DAPAS group.

The results of the study will be reported in detail in a scientific paper and published open access in a peer-reviewed journal.

However, we did not find a difference between participants using the DAPAS system and those in the control group in terms of resource use and quality of life.

Some participants and caregivers mentioned that in some cases, the DAPAS system and the exploration of new technologies increased the wellbeing status of participants, since they felt less lonely in their daily activities, especially during times of lockdown. Emma and the voice output gave participants the feeling that someone was present and that they were not completely alone. (e.g., the welcoming with the friendly voice of Emma “don`t forget, that I am here for you”, when they came home). Participants in the interviews and focus groups also reported that wellbeing in some of the older adults was increased since people had the possibility to get quick help in medical emergencies through the emergency call, which was included in the DAPAS system. This was considered the most relevant factor for the increase of wellbeing for the older adults.

On the other hand, also the use of multiple games included in the DAPAS system helped them overcome the extensive free and unstructured times during the lockdown, which in the opinion of formal caregivers had a positive impact on their individual wellbeing during these times.

11. Conclusion and Discussion

Devices and features

The evaluation of the DAPAS versions showed that although they are not cost-effective, the tablets are useful vehicles for the interaction with older adults that have not used the Internet before. The size, the usable interaction as a touchscreen and even the affordable price makes it suitable for IT projects at home with older adults.

Participants reported that the games and the reminder function were the most useful and interesting features of the system. While the EmmaHome base station helped many end-users to feel less alone by talking to them, there were divided opinions about the sensor which informed the station whether someone was in the room. Some participants liked that the base station only talked when they were in the room, other participants preferred to not get overdue reminders which are no longer relevant at the time.

The activity tracker was perceived as positive in general as well, but some participants were not satisfied with the display of the activity tracker information in the DAPAS App. They reported that not enough information was shown (e.g., number of steps is missing in the App).

Transparency, usability and functionality

The evaluation also revealed important findings regarding the importance of transparency, usability and functionality. The participants were partly overwhelmed with the amount of features in the DAPAS App and the needed hardware. It became clear that it should not be taken that much equipment into one version, because the motivation of the users can become very low.

Besides that, since the apartments of end-users were often rather small, only a small space for devices was available. Hence, product design played an important role for the use, satisfaction as well as safety of older adults. Very often, there was not enough space for many devices and laying cables could present a great danger for older adults.

The expectations of end-users were quite different to the project performance, since they expected a ready product, but were partly disappointed that many functions had bugs or did not look like ready products. For example, hardly any user rated the ambient lamp as positive (probably because it did not work properly most of the time). Besides that, it was reported that even established speech-to-text systems from Amazon and Google were unreliable to use for important tasks.

Some participants did not use the communication function on a regular basis. There might be three reasons for this: (1) Due to the pandemic, there was little personal contact with informal caregivers and therefore limited opportunities to support them in using the Kwido app (2) in some cases participants had no informal caregivers, (3) the Kwido app was only available in the iOS version after the trials had started.

User support

It turned out in the course of the project that user support in any form was very important, not only for the users, but also for the formal caregivers. It was easier to support a user through a direct phone call rather than an email because it took too long to get a response and people preferred to talk to someone in person.

Role of social interaction

Many older people appreciated the social component of the project a lot, they liked to be shown something and enjoyed the conversations away from the technical solution, which was great for the end-users, but not that useful for the project. Throughout the project, the team noticed that even though many manuals for the usage of the DAPAS system were provided, which were also written in an age-appropriate format (also with many pictures), participants resisted using them, since they preferred personal communication and training.

During the project, it was also observed that in a project focused on caring for older people, accessible communication has become a must for the end-

users, especially after the pandemic. And that the relationship with the relatives and/or informal carers also contributed to their engagement. It's good to offer technology to them, but it also needs to have a purpose for them and a motivation to increase the use and the engagement.

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“AgeWell”: www.agewell-project.eu (Accessed: 06.05.2021)

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13. Figures

14. Project team

***exthex GmbH* |**
Austria

exthex is a research and development SME that strongly focuses on close-to-market operations.
In contrast to university research whose institutions are important partners, the aim of exthex is to found spin-offs based on the results of successful research projects and to establish them on the market for the long-term. exthex puts the focus on research in the future markets AAL, IoT and smart energy management. The experienced team has been participating in national and international research projects for several years, both as coordinator and partner.

***Ideable Solutions, SL* |**
Spain

Ideable Solutions (IDE) is a software company specialized on web, cloud and mobile solutions for eldercare sector and Industry 4.0. As a company focused on eldercare sector, Ideable already has broad experience in using technology in the eldercare sector and already has signed agreements with partners and clients in Spain, Switzerland, UK, Panama, Portugal, Italy, etc. and has worked for many years in analysing eldercare sector and studying market trends and disruptive innovations for this market. Ideable Solutions is internationally recognized in this field, is highly productive and has proven experience in management of national and international network projects on eldercare sector, and with the development and international sales of its IT platform for elder caring, Kwido. Ideable is responsible for Kwido (see more at www.kwido.com) the international cloud platform for caring elderly people by accessible and usable mobile devices. It both works in promoting independent living at home, social connection, health monitoring, etc. Kwido includes a rehabilitation platform for cognitive impairment based on serious games. Also includes a complete health monitoring platform with even teleconsultation features. Ideable also participates in the zocaalo AAL project for designing a marketplace for accessible and usable apps for elderly users and caregivers, in PETAL AAL Project for improving quality of life of elderly users using lights and IOANNA for offering accessible services and products for elderly customers. Ideable is an

important stakeholder in the Spanish ehealth ecosystem and organised the eHealthBilbao congress along with the Bilbao City Council in 2015 and the AgingBilbao event for the Spanish national telecare market in 2017.

AIT Austrian Institute of Technology GmbH | Austria

AIT is Austria's largest extra-university research centre in applied research and development. AIT takes a leading position in the Austrian innovation system and a key role in Europe as the RTO focusing on the key infrastructure topics of the future. As a national and international network node at the interface of science and industry, AIT enables innovation through its scientific-technological expertise, market experience, tight customer relationships and high quality research infrastructure. AIT is represented in this consortium by the AIT group "Biomedical Systems" from the Center of Health & Bioresources. The group has been involved in R&D on Active and Assisted Living technologies as well as medical research since 1994. The research focus lies in the AAL domain on behaviour pattern recognition, middleware platforms and services and user interfaces.

University of Deusto, eVIDA | Spain

eVIDA is a research group of the University of Deusto committed to research on and development of ICT-based tools, systems and interventions for psychological, social and physical health. Over the last decade, eVIDA has established close working relationships with key local stakeholders including hospitals, charities, other research groups and ICT companies. eVIDA conducts applied research in two main areas. In the field of ICTs for Wellbeing, eVIDA researches, designs, develops and tests tools and systems which enable disabled people and the elderly to live more independent lives. eVIDA is involved in creating apps and for person-centred care, and various tele-medicine and tele-monitoring systems. Work in this area has included applied research aimed at assisting groups such as people with intellectual disabilities, people with autism, people with visual impairments, people with hearing impairments, and people with multiple sclerosis. In the field of health, eVIDA is specialized in creating diagnostic tools and systems and interventions for people with health. eVIDA is participating in SUNFRAIL project from the 3rd health Program, CATCH ITN Marie Sklodowska-Curie action and is active in EIP-AHA groups.The results of its research

and its application have been published in over sixty scientific articles in international journals and books and have been presented over than 150 international scientific conferences. eVIDA has been awarded with the University of Deusto Banco Santander Research Award in 2007 and the ONCE Euskadi-Solidarios Research Award in 2007.

SHD is the largest not for profit community nursing, health and social care Provider in Luxembourg. Besides general nursing activities, support in acts of daily living (ADL) and domestic support task, SHD also provides specialised nursing and therapeutic care including palliative / end of life care. Although SHD caters for all age groups it specialises in the care of elderly people. The care provided is 360° around the needs of each individual client through the support of a range of health professionals such as physiotherapists, occupational therapists, psychologists and dieticians. It also manages a number of Day Care centres which are caring for people with severe disabilities as well people suffering from mild to severe forms of dementia.
Since 2001, SHD manages Sécher Doheem Telecare service and has been using technologies such as fall, epilepsy detection and mobile geofencing sensors.
SHD has been involved in various AAL projects since 2013 and is funded through the Fond national de la recherche (FNR).
SHD

Medical University of Vienna* | *Austria

Founded in 1365 as Medical Faculty and independent since 2004, the Medical University of Vienna (MUW) is today one of the most traditional medical training and research facilities in Europe. With its 26 university hospitals, 3 clinical institutes, 12 theoretical medicine centres and numerous highly specialised laboratories, it is included among the most important cutting-edge research institutes of Europe in the area of biomedicine
. Its own laboratory building with highly specialised “Core Facilities” was inaugurated in June 2010 with the “Anna Spiegel Research Building”. 5 Research Clusters unite MUW competences in an interdisciplinary way – across departments:
Immunology, Cancer Research/Oncology, Medical Neuroscience, Medical Imaging, Cardiovascular Cluster. Because MUW closely combines fundamental research and clinical application, the newest research results benefit, among others, the 670.000 university hospital patients every year: in

the University General Hospital (AKH) about 1.500 MUW doctors treat more than 100.000 inpatients and about 540.000 as outpatients each year, based on the latest research findings. At the same time findings from clinical routine are reintegrated into research, e.g. through clinical studies.
MUW is dedicated to the triple track strategy – the simultaneous operation of research, education and patient care as equally important core tasks. These three cornerstones of research, education and the treatment of patients each contribute equally to the medical and scientific quality of the university.
The Section for Outcomes Research at the Center for Medical Statistics, Informatics, and Intelligent Systems of the Medical University of Vienna analyses outcome data in healthcare, develops corresponding instruments, optimizes measurement scales and adapts assessments to different contexts. Outcomes include the measurement of clinical signs and symptoms as well as results of medical interventions, but also quality of life, functioning, pain, fatigue or the impact of exercise-induced dyspnoea in daily life – outcomes which are most important for patients.
In people with acute and chronic health conditions of the cardiovascular system, other internal organs or the musculoskeletal system, in children, in older adults and in rehabilitation, it is essential to include the perspective of patients into outcome measurement. The Section for Outcomes Research develops methods to measure, analyse and compare outcomes in healthcare by using complex scores, patient-reported instruments, multivariate models, Rasch analyses, mixed methods, and activity- and motion-analyses. Data gathering is optimized with sensor technologies and digital health solutions. Furthermore, qualitative research methods are developed and applied.
The MUW has recently developed a strategy to create a digital health hub targeting prevention and occupational health in the coming years.
MUV

NEW DESIGN UNIVERSITY
PRIVATUNIVERSITÄT ST. PÖLTEN

***New Design University* |**
Austria

The New Design University sees itself in continuous dialogue with the intensive development of society, which should be observed and investigated. Social and technological developments, scientific knowledge and artistic achievements must be comprehended in their interaction in order to develop a conception of the social dynamics.
During previous projects within the AAL joint program NDU gathered a high level of experience in

leading user requirements engineering work-packages applying the user-centred design development process methodology and using as well the ISO 9241-210 standard for the involvement of end-users for the user requirements engineering studies in these research projects. In particular NDU's user-inspired innovation process methodology focuses on preferences in technology acceptance, technology use as well as on preferences of end-users for aesthetical and emotional product criteria. For the studies with end-users NDU uses methods of on one side qualitative social research and on the other side methods of design research. The use of such a trans-disciplinary research approach aims at creating a "best of both" research methodology to receive extensive data about the everyday life routines, wishes and demands of the end-users of a project.
Furthermore NDU has the capability to contribute to subsequent product design development phases by creating holistic product concepts and mock-ups to ensure the alignment of a technology development which fulfils true end-user needs. In past projects NDU gathered experience in creating design concepts which focus on social connectedness, active ageing and the empowerment of our elderly generation. Moreover NDU has been contributing to the evaluation work-packages in recent research projects. As a scientific partner NDU has additionally a profound expertise in the contribution to dissemination activities to research projects.

Cáritas Diocesana de COIMBRA

Caritas Diocesana de Coimbra* | *Portugal

Cáritas Coimbra is an NGO that supports around 26.500 people/year with health, social and education services in the Central Region of Portugal. It has nearly 90 centres (with 149 different services), 1000 workers and 150 volunteers. Cáritas Coimbra is actively involved in many regional, national and international projects and is a member of Ageing@Coimbra, a EIP-AHA reference site with 3 stars; is a founding member and Vice-President of the European Covenant on Demographic Change; Coordinator on the D4 group of the EIP-AHA – Age-friendly Buildings, Cities and Environments and Coordinator of the Thematic Network Smart Healthy Age-friendly Environments. Cáritas has been very active on matching digitalization with end-user needs, developing high skills on the assessment and compliance of ethical issues on ICT, usability and easiness of use for people in frail conditions and also on the field development of pilots.

***Red Cross Styria* |**
Austria

The Austrian Red Cross – A worldwide movement
"To improve the lives of vulnerable people by mobilizing the power of humanity." This is the mission statement of the 191 Red Cross and Red Crescent societies around the world.
The Styrian Red Cross is one of nine national associations in Austria, covering the following main departments: Blood program, Ambulance services, Direct Emergency Call, Disaster Management, Training-Services, Youth Red Cross, First Aid and Development-Cooperation and Health and Community.
In 2017, the Styrian Red Cross had around 13.000 employees, who were living the mission of helping people each day. As a result, over 1,5 million emergency calls and 560.000 rescue and ambulance operations were carried out in 16 different districts within the entire national region of Styria.
One big achievement of the Styrian Red Cross has been celebrated with the 40-year anniversary of its 'Mobile Care Services' division, which carried out 450.500 home visits and supported over 5.200 elderly people in 2017. Another milestone has been set with the department of 'Direct Emergency Call', which ensured the 24/7 safety for more than 5.700 people, most of them living alone. Furthermore, 60 people lived in 'Red Cross Assisted Living-Houses', while about 80 people received the 24 hours care within their private residence. Also 'active aging' played an important role during 2017 with a participation of about 2000 visitors at different meetings for elderly people promoting the ideas of 'active aging' and staying in good shape during grandevity.