AAL-Pilot Concepts in Carinthia and Styria

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Abstract: Seven pilot region projects for developing and evaluating Active and Assisted Living technologies are implemented in Austria until 2019. Two of them (RegionAAL in Styria and Smart VitAALity in Carinthia) are introduced in this paper according to their realization, implementation and evaluation concepts. The first results and perceptions of these pilot regions are also described.

1 INTRODUCTION

1.1 Related Work: AAL Regions in Austria

Demographic development and its consequences has been a well-known topic for more than a decade now and various initiatives take place on (inter-)national level in Europe focused on related opportunities and challenges. These are known as research funding programs about active ageing and healthy living (AHA) and the *Active and Assisted Living Joint-Program* (AAL) which has published 11 calls[1] since 2008. More than 150 transnational innovation projects were funded. Different areas of daily life were handled in this programme in the years 2008 to 2013, for developing ICT based solutions for e.g.

- the management and Prevention of chronic conditions of older adults
- advancement of social interaction of elderly people
- advancement of Older Persons' Independence and Participation in the "Self-Serve Society"
- advancement of Older Persons' Mobility
- (self-) management of Daily Life Activities of Older Adults at Home
- supporting Occupation in Life of Older Adults

Since 2014 the calls of the AAL Joint Programme were defined more open to foster a broader variety of proposals submitted:

- care for the future
- living actively and independently at home
- living well with dementia
- integrated Package of Solutions
- smart Solutions for Ageing well

gAALaxy[2] is an international pilot region in Austria (North Tyrol), Belgium (Flandern) and Italy (South Tyrol) that provides a bundle of AAL technology (e.g. fearless fall detection sensor[3] or the Smart Home Austria[4] bundle for light and energy consumption control) with intelligent services behind. It is funded by the AAL Joint Programme initiative (call 2015). The project lasts from Mai 2016 to October 2018 with a field trial of twelve months separated into two phases with overall 150-180 participants.

In Austria the program *benefit*[5] has been operated over nearly the same period of time with rather open calls and AAL test regions were included in the

[1] **Previous calls of AAL-JP** - www.aal-europe.eu/stay-up-to-date/calls (08.03.2019)
[2] **gAALaxy** website - www.gaalaxy.eu (08.03.2019)
[3] Website of **fearless** (the intelligent fall sensor) - www.cogvis.at/fearless.html?lang=en (08.03.2019)
[4] Website of **Smart Home Austria** - www.smarthome-austria.at (08.03.2019)
[5] FFG **benefit** website - www.ffg.at/benefit (08.03.2019)

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annual calls since 2012. So far seven test regions were started and three did already finish in this time period. The regions RegionAAL and Smart VitAALity are both aiming towards an independent and healthy life for the primary users. Both regions are using integrated mobile technologies like tablets and smartwatches in combination with user-oriented services. Nevertheless differences exist in the settings, products used and services offered as compared in this paper.

Table 1: Overview on Austrian AAL pilot regions, enhanced from (Ates et al. 2017).

	Duration	Location	Households/persons
moduLAAr[6]	09/2012-12/2015	Burgenland	50
West-AAL [7] Error! Reference source not found.	01/2014-05/2017	Tyrol and Vorarlberg	74
ZentrAAL[8]	01/2015-12/2017	Salzburg	60+60 *
RegionAAL[9]	09/2015-09/2018	Styria	100+100 *
WAALTeR[10]	12/2016-11/2019	Vienna	83+35 *
Smart VitAALity[11]	01/2017-12/2019	Carinthia	100+100 *
fit4AAL[12]	01/2018-12/2020	Vienna and Salzburg	planned 100 + 100*

** Intervention + control group*

1.2 Project RegionAAL

In 2013, Styria accounted about 13% of long term nursing home residents whose care needs were only between levels 0 (no need for care) and 2 (moderate need for care) out of 7. Therefore, other factors than the actual care need may have caused these people entering a nursing home. This means that with a total number of around 11,200 nursing home residents at that time, about 1,450 could have been provided elsewhere with the use of suitable assistance. (Health-Joanneum Research, 2015)

Very common reasons for avoidable admissions in nursing homes are loneliness, social isolation, and low self-responsibility for health-sustaining behaviour reflecting the state of knowledge of the office for Science and Health of the Styrian Provincial Government. But there are other reasons as well and the cooperative AAL research project RegionAAL researches which kind of assistance (technology and services) may reduce the number of persons entering nursing home for care levels 0 to 4.
An initial analysis on evidence of efficacy and acceptance of technology assistance defined the basis within the project for a services and technologies package combining different existing technologies. An essential requirement of the package was that it can be used after the project. The package was tested in a large-scale pilot (110 households, one year test period, mainly in the urban areas of Graz, Leibnitz and Deutschlandsberg). The accompanying evaluation was done as an RCT with same sized intervention and control groups.
The major aims of RegionAAL are twofold: on one hand people shall be assisted by technology and services to be able to stay longer at home and on the other hand information on these possibilities shall be made available to a broader audience.

1.3 Project Smart VitAALity

Smart VitAALity, the Carinthian pilot region for AAL and Smart Living Technologies, is implemented as cooperative AAL research project with the aim of developing and multiperspectively evaluating a technical solution connected to a subset of integrated services. The project is implemented in the urban triangle of Klagenfurt, Villach and Ferlach. The developed AAL solution is tested and evaluated over 16 months by persons =60-85 years. They should live independently in their own homes and take an active part in their own life.

The focus of the system and the accompanying services was set on two domains affecting the subjective quality of life (sQoL) of older people: health and wellbeing, as well as social participation.

Interventions in the area of health and wellbeing are aiming to improve the health competency of the users in general and to encourage the usage of digital health management applications. Interventions in the area of social participation are dedicated to increase the general user competence regarding digital information and communication applications and services, as well as supporting the users in creating, maintaining and extending their social networks. The overall aim is to foster social inclusion, life-long learning and valuable activity and participation.

[6] Website **moduLAAr** - www.modulaar.at (18.1.2019)
[7] Website **West-AAL** - www.west-aal.at (18.1.2019)
[8] Website **ZentrAAL** - www.zentraal.at (18.1.2019)
[9] Website **RegionAAL** - www.regionaal.at (18.1.2019)
[10] Website **WAALTeR** - www.waalter.wien (18.1.2019)
[11] Website **Smart VitAALity** - www.smart-vitaality.at (18.1.2019)
[12] Website **fit4AAL** - www.fit4aal.at (18.1.2019)

The impact of these interventions on the selected domains is evaluated in the domains of usage frequency, technology acceptance and user experience as well as in defined domains of subjective quality of life. In order to create an argumentative basis for anchoring individual components and services on the market, a socio-economical potential analysis is performed. The evaluation is realized as a controlled study including N=230 households (n=105 in the intervention n=121 in the control group).

2 METHODS

2.1 Project RegionAAL

2.1.1 System Components

The technologies used for the households in the RegionAAL test phase included: a wireless mobile door bell, a tablet with a customized user interface (UI), a smartwatch with fall detection and alert calls/messages, an automatic sensor based stove shut down, as well as light assistance with automatic night light and radio switched light.
Several areas of assistance, like health and wellbeing, information, communication, entertainment and safety, were addressed with the components.
All test households in RegionAAL were equipped with the same components except light assistance (installed depending on the specific needs of a person and the room situation in the household).
Tablet: The functions (interventions in our study context) on the tablet included: vital data at a glance, reminders (e.g. medication), training videos, emergency calls, calendar and daily agenda, (video) phone calls, photos and games.
The functions on the tablet were offered via a commercially available system (customizable UI in kiosk mode and apps). Further necessary apps were added and the standard UI of the base system adopted. The setup was done during technology preparation in close cooperation with older adults and assisting staff from the care organizations in RegionAAL.
A Samsung tablet was equipped with a rubber case for better handling and a magnetic charge adapter for easier use than the standard micro-USB interface.
Smartwatch: The smartwatch provided beside the obvious date/time functionality a fitness tracker with step counter, various reminders (e.g. medication, drinking, events etc.) and a fall detection with alerting calls.

Recherché and tests on available fall detection apps for mobile devices showed that there exists a huge number of such apps, but none of them was practical for RegionAAL due to several reasons: not working (properly), only available in English language and thus not understandable, including lots of advertising or optimized for smartphone displays. Joanneum Research developed an app for that purpose.
The smartwatch offers full phone and internet functionality. Both tablet and smartwatch were equipped with a SIM card (different phone numbers).

2.1.2 Integrated Services

In order to keep the seniors interested, a telephone hotline with a personal contact person has proven itself. Problems were taken care of quickly and the elderly people did not feel left alone in using the applications. The telephone centre was manned weekdays from 8 a.m. to 3 p.m. in order to answer customer calls. For technical problems concerning the stove shutdown or the individual light solutions, a hotline was permanently manned by employees of the project partner "Elektrotechnik Resch".

Monthly meetings for the participants helped to maintain motivation in using the application and learning how to use the technologies. The seniors had the opportunity to learn the use piece by piece. Together they repeated the applications regularly. In addition, the regular meetings allowed showing the older people the relevance of the technologies for their personal situation (i.e. which of my everyday problems can be solved by the technology).

2.1.3 Usage Analysis

Within the evaluation of RegionAAL interest was laid on the usage of interventions (i.e. apps) on the tablet. For the smartwatch the interest was on the falls, which were detected.
For tracking the handling with apps, the app "App Usage Tracker"[13] was installed and the appropriate log files were transferred from each device for evaluation purposes. The tracking was only done on application level, i.e. telling about the date/time of starting the app and the estimated duration of particular uses. No details were acquired on how the apps were used or what was entered when using the apps. The app for fall detection on the smartwatch is

[13] **App Usage Tracker**-https://play.google.com/store/apps/details?id=com.agrvaibhav.AppUsageTracking(08.03.2019)

a constantly running application. The tracking of falls and if consequential emergency calls were deactivated by the user, was done directly in the app included date/time and type of occurring events.
Regarding the use of tablet-based applications and their acceptance**,** the participants filled a paper-based survey. The control group documented the falls, detected with the smartwatch, in a paper-based form.

2.2 Project Smart VitAALity

2.2.1 System Components

In addition to the interaction ace components (tablet and smartwatch), the Smart VitAALity system contains hardware components like environmental sensors and vital parameter measurement devices etc. In the course of this paper we set a focus on the devices with self-implemented software and human-system interaction, namely the tablet and smartwatch devices.
Tablet: In the project an off-the-shelf Samsung tablet equipped with a rubber case.
The tablet offers open usage, which means there is no kiosk mode that restricts the user to one application. This evokes the risk that users may accidentally change settings or crash the tablet, but supports one important aim of the project: to enhance the media competency of the users. Additionally, a first level support hotline process was established to accompany the users, if assistance with the tablet or other components is needed. On the tablet, the users have the opportunity to use the Smart VitAALity app with the three main functionality clusters: health, information and communication, which are related to the described sQoL domains health and social participation.
"Health" includes a vital parameter tele-monitoring component for self-visualizing blood pressure, blood sugar level and body weight, a diary function to rate the personal wellbeing and take notes, a self-organized medication reminder and a visualization of distinct activity levels, based on the fusion of step counter of the smartwatch and the environmental sensor data.
"Information" covers content and apps providing regional information like drugstore opening hours, medical services during weekends, appointments for garbage removals, information about regional events and a personal calendar including moon and pollen information.
"Communication" comprises functionalities like e-mails[14], WhatsApp[15] and FragNebenan[16], which is a digital neighbourly help.
Smartwatch: The smartwatch realizes its own connectivity to the internet that it can be used everywhere and independently of other devices. Key functionalities are comprised of a simple watch functionality, a step counter and an emergency call function with an optional call centre (with a 24/7 accessibility). Additionally, a calendar function is included on the watch, which interacts with the tablet's calendar.

2.2.2 Integrated Services

The proposed technical system is planned and integrated together with accompanying services. In case of Smart VitAALity the following integrated services are available: A tele-monitoring component was implemented in the form of a medical care centre including a multilevel health coach approach. Beside regular feedback and contact sessions, according to an escalation strategy depending on the individual vital parameter curve, a medical expert provides support for the users by phone.
The smartwatch is the interface to the integrated emergency call service including a self-defined emergency chain with personal emergency contacts, an option for a professional 24/7 emergency call centre. If an emergency is signalized via smartwatch, the emergency call chain is started and the contacts receive an automated call and have the possibility to call back. Additionally, a message with position data and access to the associated web portal is communicated.
An additional service during the project is a technical support hotline, where the users can communicate arising questions and problems regarding the system. The hotline is available for the participants on each working day from 8 a.m. to 4 p.m.
The intention of this service is to stay in contact with the users during the test phase and encourage continuous usage of the system by bridging usage barriers on the one hand and to gain feedback about the system status in real time to ensure a fast reaction to technical problems.

2.2.3 Usage Analysis

The usage of the tablet computer and the smartwatch is tracked in two different ways.

[14] **G-Mail** - www.google.com/gmail (08.03.2019)
[15] **WhatsApp** - www.whatsapp.com (08.03.2019)
[16] **FragNebenan** - www.fragnebenan.com (08.03.2019)

For the usage of the Smart VitAALity app on the tablet computer the software Matomo [17] is used in combination with project internal analysis tools. It is installed on the tablet computer and tracks every button tap in the application. The usage of the applications outside the Smart VitAALity app is not tracked according to privacy guidelines. However, at the end of the field trial, a short survey will be realized to gather the relevant information concerning the usage related to these applications (how often are other apps used, which kind of apps are used, are users able to use the tablet computer independently, etc.).
The usage of the smartwatch is tracked by using an interface which tracks taken steps in combination with time information (indicates that the watch is worn) and total number of emergency call triggering.
The evaluation of the usage shows if devices are used, the total number of usage and any deviations during the usage according to age and selected influencing parameters.

3 RESULTS

3.1 Comparison of the Systems

To compare the used technologies in the two pilot regions the following clusters are used: components – which hardware is chosen, functions – which functions/ topics are relevant in the project, handling – concept of usage and support and implementation – how many interfaces and their usage.

3.1.1 Components

RegionAAL
Tablet computer
• Samsung Galaxy Tab A 10.1 LTE T585 (enhanced with a 32 GB memory card for the trainings videos)
• asina software package
• an additional app launcher replacing the asina app launcher
• several apps in addition to the asina package
Smartwatch
• Finow X3plus (standard android installation)
• self-developed fall detection
Smart VitAALity
Tablet computer
• Samsung Galaxy Tab A 10.1 LTE (2016)
• Tablet is rooted but commercially available as it is
Smartwatch
• Omate S4 / Safemotion[18] Edition
• Customized software

[17] **Matomo** - www.matomo.org (08.03.2019)

3.1.2 Functions

RegionAAL
Health and wellbeing
• Vital parameters (blood pressure, blood sugar, body weight)
• Physical training support via (live) videos
• Active daily routine (Step Counter)
• Medication reminder
Information, communication & entertainment
• Internet, weather
• Event calendar and personal agenda / tasks
• (video) phone, SMS, Photos, Games
Safety
• Fall detection and emergency/assistance calls
Smart VitAALity
Health and wellbeing
• Vital parameter measurement monitoring (blood pressure, blood sugar, body weight)
• Diary, Active daily routine, medication reminder
Social Participation
• Drug store opening hours
• Doctors emergency service on weekends
• Event calendar, Newspapers
• Calendar (incl. moon and pollen calendar)
• Garbage removal
• Internet, e-mail, WhatsApp, FragNebenan

3.1.3 Handling

RegionAAL
Tablet
• Kiosk mode and no possibility for adding apps
Smartwatch
• Open access to watch faces and all functionalities which could not be deactivated or hidden with reasonable effort
Support
• For all devices tested in this test region, a support hotline existed for the users. (Mo-Fr from 8 a.m. to 4 p.m.) If necessary, a technician drove to the user to help locally.
Smart VitAALity
Tablet
• Open access to all functionalities
Smartwatch
• Controlled access to the watch functionalities – according the pre-defined use cases
Support
• For both devices as well as the not mentioned other devices, a support hotline is available (Mo-Fr from 8 a.m. to 4 p.m.). If necessary, a technician will drive to the user and helps locally.

[18] **Safemotion** - www.safemotion.org (08.03.2019)

3.1.4 Implementation

RegionAAL
Tablet • use of selected asina[19] platform apps according to the user requirements • use of the web based asina backend for maintenance of asina clients on the tablets • replacement of the asina app launcher with the more flexible Apex launcher[20] with UI designed and layouted as defined together with potential participants and staff members of involved care organizations • use of app "App Usage Tracker" for tracking use of user apps and integration of several 3rd party user apps according to the user requirements • implementation of a web based information portal based on WordPress content management system[21] **Smartwatch** • standard Android installation with unnecessary apps deactivated and hidden as good as possible with reasonable effort • implementation of the fall detection and alarming app including logging facilities for detected events
Smart VitAALity
Tablet • Self-implemented application based on James application [22] from ilogs – changes in customization: pre-installed Smart VitAALity app and update function app "ilogs Agent". • Barrier free design approach – users can change font size, and colour schema (night mode, high contrast mode) • Human-system interface design / navigation strategy based on requirement analysis • Interface to the ilogs backend: for updates and support and to synchronize the tablet computer smartwatch • Interface to the ilogs care centre: for logging vital parameter measurement values and for the care centre support • Interface to the Carinthia University of Applied Science (CUAS) / FIWARE server[23]: for logging the usage with Matomo **Smartwatch** • Customized Android version for the Smart VitAALity app • Restriction of the commercially available functionalities • Interface to the ilogs backend: for support and receiving relevant information according the emergency calls and step counter logging

[19] **asina** package - www.asina.de (08.03.2019)
[20] **Apex Launcher** - https://play.google.com/store/apps/details?id=com.andoes.launcher&hl=en (08.03.2019)

3.2 Results of the Usage Analysis

While the **RegionAAL** participants liked the tablet (with all software and additional hardware for easing use), a great majority disliked the smartwatch. The major issue with that device was the short battery lifetime according to the rather energy consuming application set (phone and internet services with lots of re-connecting, GPS location and the fall detection) on that device. The participants using the watch and others showed great interest in the fall detection and announced the importance of such a feature. Smartwatch users among the participants also experimented with other apps and the available watch faces, but mentioned that the use of this technology is harder than the tablet use, due to smaller sizes of buttons, navigation and UI elements.

The use of the tablet varied between participants from nearly no use up to about 500 hours over the whole test period. A first analysis of app usage on the tablets showed that information (internet access via a web browser, 54%) and the installed games (mainly Sudoku and 2048, 36%) were the most frequently used applications, followed by communication (5%). Some apps created interest but were obviously not easy to use, as said in interviews with participants. Video telephone (skype was integrated into the platform and contacts maintained by persons supporting the participants) is an example for that.

About 30% of test users kept the tablet after the project for private use. However, the seniors wanted to have a standard UI rather than the customized UI in kiosk mode to use the tablet just like their children and grandchildren do.

In **Smart VitAALity** the usage analysis is not yet finalized. An interim evaluation showed that more than 50% of the user group uses the tablet more than 3 times a day, mainly for the health functionalities like the monitoring component for blood pressure, blood sugar or body weight parameters. The users, who also wear the smartwatch every day (33%), heavily frequent also the step counter-monitoring component on the tablet. About two third of the users wear the smartwatch more than three times a week, mainly for outdoor activities.

Other functionalities on the tablet like FragNebenan are predominantly used by experienced users, because the handling is different to the self-implemented functions like the health functionalities and therefore difficult for non-experienced users.

[21] **WordPress** - www.wordpress.org (08.03.2019)
[22] **James** by ilogs - www.freedomjames.com (08.03.2019)
[23] **FIWARE** - www.fiware.org (08.03.2019)

3.3 Support Effort

A crucial service for enjoying the use of AAL technologies for the seniors is a good introduction and support in the application. This can be either a telephone hotline or regular personal meetings.
Supporting the elderly people in using the AAL-technologies is time consuming and often underestimated. Offering a good introduction into the technologies can take up to 400 hours (for 30 people). The regular support through hotlines and meetings for a one-year-period requires up to 1500 hours (for 30 people). However, the effort of support significantly decreases over time.
In the Smart VitAALity project, the rollout phase was organized very user-focused with a comprehensive introduction to the system to minimize usage barriers. About 530 hours were spent to rollout the Smart VitAALity system to all test group participants (travel times not included). Additionally, in the first eight months of the field trial more than 200 support trips including enhanced training sessions, replacement/reparation of defective devices, battery changes and supply of disposables were made.

4 DISCUSSION

The two test regions took different approaches regarding the mobile technologies, which they offered to participants, namely tablet and smartwatch.

4.1 Open vs Locked UI on the Tablet

Having the tablets in **RegionAAL** run in kiosk mode with a fixed set of apps was strongly motivated by offering a mostly identical set of interventions to all participants as defined in the study protocol. Several interventions were provided as particular apps and it was the intention to test and evaluate their efficacy but not the dis-/advantages of apps. Another aspect was the risk of a higher supporting effort with an open system. The project team was not able to take that risk with the rather large number of participants and as there were no mechanisms for remote maintenance included. Still some updates were to be performed on the systems by staff of technical partners and the caring organisations.
As part of the RegionAAL exit strategy after the test phase participants could keep their tablets. Many of them decided to have the tablet reset without a kiosk mode and with standard apps (e.g. WhatsApp, Email), to be more flexible with offered functionality (e.g. contact management or sending/deleting photos and videos).
The decision to provide an open tablet access for the **Smart VitAALity** users was made with the intention to create responsible and empowered users regarding the usage of information and communication technologies in general and not only for the provided application. The prior experience of the user group regarding mobile communication tools such as tablets or smartphones was also very diverse and therefore the chosen approach provides also more experienced users the chance to enhance their competencies. The advantage of the open approach lies in the acceptance and the usage of the provided system, but it is also very hard to monitor the usage of some of the provided interventions because they can also be reached from outside the project related app. Also the maintenance of the system can be a problem because the system settings can be reached by the users, but in Smart VitAALity no significant amount of support activities was related to such issues.
Beside the important health monitoring functions, WhatsApp exposed to be a trigger function for the usage of the Smart VitAALity tablet. People with a too old smartphone or without any WIFI connection on their phones noted during the requirements analysis that they want to have a WhatsApp connection. The importance belongs to the fact, that children and grandchildren are using this application for digital communication, and they want to participate in that process. According to spoken feedback, these people are very happy for that and now they feel as a part of the community (again).
Even the complex user interface is not a border for the usage of WhatsApp whether they have a hard time dealing with the app functionalities or not. The personal requirement to be part of the digital “family and friends”- communication prevails over personal fears or discomforts of interacting with the function.

4.2 Smartwatches

Although the main functionality of the smartwatches was different (emergency call vs. fall detection), a step counter on the watch was provided in both projects. The main intention of this functionality was to motivate the users to exercise every day. In course of both projects some issues with the synchronization of counted steps between watch and tablet occurred (some steps were lost) and many users complained about these issues. This shows that such fitness functionalities would be well accepted by the users, but only if they work out accurately and correctly. Therefore, there is a need to catch up with the state of

the art of already existing fitness trackers and to include these functionalities into the used smartwatches to create an added value for the users.
The fall detection was mentioned as a very useful and important feature for feeling safe. Both participants and supporting persons or family members reported this.

5 CONCLUSION

A central element of the development of AAL technologies is the active involvement of the target group. A user-centred design throughout the whole project ensures that the solution is oriented towards the needs of the target group. Frequent feedback loops and constant contact with the target group are central components. Our experience shows that seniors are happy to participate and appreciate it when they are involved in such developments.
Another important point is to provide easy accessible contact points and services for the users also during the field trial. Experiences show, that personal contact, assistance as well as and taking into account the feedback of the users (especially regarding problems, failures or struggles) is a crucial point in determining success or failure of an AAL solution. Furthermore, taking users seriously also strengthens their self-confidence and consequently also their competence in dealing with technical solutions.
Developments in the AAL area should definitely take into account a design-for-all approach. Using tablets with standard UI works pretty well (except text entry) with older adults and are then very well accepted. Supporting effort is not that huge, if users are well trained at introduction time. Technologies have to be developed for certain use cases but not for "old people" per se. This prevents stigmatization and opens up new potential in the fields of AAL.
Smartwatches are of great interest alos to older adults and would be accepted, if some shortcomings (e.g. breaking wrist bands, short battery runtime, incomprehensible shutdown and reset to factory settings) can be solved. Therefore developments and improvements of this technology shall be followed.

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