AAL

P R O G R A M M E

FINAL
PROJECT REPORT

– VirtuAAL –

Please send this report <u>ELECTRONICALLY</u> to the Central Management Unit (CMU) as well as a copy to the National Contact Persons (NCPs) of the coordinator and project partners

The coordinator of the project must submit this report within 30 calendar days after the final date of the project, on behalf of the consortium.

**If you have any additional question,
please contact the AAL CMU at _CMU@aal-europe.eu_,
or your NCP (see details on _www.aal-europe.eu/aal-ncp_)**

Report date	24/10/2019

PUBLISHABLE PROJECT INFORMATION (TO BE USED BY AALJP)

<table>
<tr><td colspan="2" align="center">1A. PROJECT</td></tr>
<tr><td>Project full title</td><td>Virtual and Augmented reality for combating cognitive - VirtuAAL……</td></tr>
<tr><td>Project acronym</td><td align="center">VirtuAAL</td></tr>
<tr><td>Project No.</td><td>aal-call-2018-150</td></tr>
<tr><td>Project Website</td><td align="center">https://virtu-aal.eu/</td></tr>
<tr><td>Project duration</td><td>●   Starting date: 02/05/2019
●   Termination date: 31/10/2019</td></tr>
<tr><td>Coordinator's name and details</td><td>Full name: José Ignacio Bartolome Martin
E-mail address: ibartolome@ideable.net
Telephone number: +34 946414447

* Both e-mail address and tel. number must be provided.</td></tr>
</table>

<table>
<tr><td colspan="6" align="center">1B. PROJECT PARTNERS</td></tr>
<tr>
<td>NO.</td>
<td>PARTNER ORGANISATION NAME</td>
<td>PARTNER ORG. ACRONYM</td>
<td>TYPE*</td>
<td>PROJECT COSTS: PUBLIC GRANT IN EURO</td>
<td>PROJECT COSTS: PARTNER OWN CONTRIBUTION IN EURO</td>
</tr>
<tr><td>1 (coord.)</td><td>Ideable Solutions, SL</td><td>IDE</td><td>SME</td><td>50.280,00 €</td><td>33.520,00 €</td></tr>
<tr><td>2</td><td>Ana Aslan International Foundation - Fundatia Ana Aslan International</td><td>ANA</td><td>END USER</td><td>74.947,00 €</td><td>0€</td></tr>
<tr><td>3</td><td>Center for Assisted Living Technology, Health and Care, Aarhus Municipality</td><td>CAT</td><td>END USER</td><td>94.140,00 €</td><td>10.460,00 €</td></tr>
<tr><td>4</td><td>University of Deusto, eVIDA</td><td>DEU</td><td>RTD</td><td>49.307,50 €</td><td>40.342,50 €</td></tr>
<tr><td colspan="6" align="center">*Please select one of these options: SMEs, Large, END USER, RTD, other</td></tr>
</table>

1C. PUBLISHABLE PROJECT RESULTS SUMMARY *(1 PAGE)*

The goal of this project is to develop immersive serious games to increase motivation in elderly patients in nursing homes or daily centers and, above all, test the using of these technologies (more mature and affordable nowadays) in combating cognitive impairment. We will especially focus on some mental capacities that could be trained and measured, such as attention or executive functions. And we would analyze both impact in cognitive status but also the feedback of those elderly users to conclude if there's a sustainable business model behind VR & AR related to therapies against cognitive impairment.

Virtual and Augmented reality seems to be a promising field of using ICT in eldercare sector, but for the moment very few initiatives have aroused, for many reasons (prices of devices, lack of accessibility) and in most of the cases those experiences are focused in physical rehabilitation, especially in the use of Kinect devices (that is no longer a commercial product). If the results are promising, we will create a commercial product based on a SaaS platform for deploying AR / VR cognitive therapies for elderly users. We would, of course, spread the news around the AAL community and the eldercare sector around Europe. The first version of this platform would be created over the results of the current small collaborative project.

Cognitive stimulation platforms are now oriented to their usage in daily centers and nursing homes to be performed by therapists manually due to the lack of accessible and scalable software platforms. Even patients' cognitive level was manually assigned by psychologists and geriatricians. All the work focused on trying to perform daily activities (games, going to the bank, cooking, etc.) is still done manually or discarded. So, therapies to motivate them and help them in real environments are usually discarded.

How many customers could be impacted?
•   The number of elderly people? 18,75% of the European population older than 65 years.
•   The number of cognitively impaired people? About 46,8 million people were affected by dementia worldwide (10,5 million in Europe) and in 2050 they will be 131 million (18,7 million in Europe).
But the real customers will be the nursing homes and institutions working for elderly users.

Until now, cognitive stimulation platforms were oriented to their usage in daily centers and nursing homes as these therapies were been managed by therapists manually due to the lack of accessible and scalable software platforms. When talking about technical platforms, touchscreens and tablets with serious games are the only options for these

3

end-users. Even Ideable has already launched its own platform for combating cognitive stimulation using games, called Kwido Mementia.

And regarding VR & AR and its use in elderly patients, most of the initiatives are focused on physical rehabilitation or subjects outside cognitive impairment.

The values of VirtuAAL:

• A total immersive and accessible experience for elderly patients using the combination of HTC VIVE glasses and Leap Motion.

• The therapies are focused on cognitive stimulation training and the detection of possible cognitive impairment.

• VirtuAAL also includes the possibility of working in daily activities.

• VirtuAAL already links to a cognitive stimulation platform that includes also training with serious games on touchscreens, tablets and computers.

Our value: A new disruptive and motivating platform to combat cognitive impairment using VR. These new technologies have a significant impact on the motivation of the end-users, apart from helping them preventing possible cognitive impairment problems. Also it helps them to perform tasks in daily activities.

A total of 33 primary end-users from Romania were involved in the Final Trial from 35 that subscribed (2 were excluded). Of the 33 involved primary end-users, 25 were female and 8 were men. The end-users were autonomous elderly living in Bucharest or close to Bucharest. Most of them had an active living and they were involved in many activities in the Senior's Clubs (as some of them described: photography courses, language courses, dancing, singing, theater playing, physical exercises, playing strategy games and socializing).

A total of 22 primary end-users from Denmark was involved in the Final Trials. Of the 22 involved primary end-users 13 were female and 9 were men. The average age of the end-users who participated in Denmark was 74,5 years old.

We will reach the market in 3 months after the end of the project using the Kwido VirtuAAL trademark.

Main possible barriers:

• Changing regulatory requirements
• The market requires compatibility with new ICT standard
• Inability to meet researchers requirements
• Underperformance in real conditions
• Wrong feedback from early adopters
• The entry of new competitors in the market
• Costs of the existing solution.

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3 A. PROJECT RESULTS - SCIENTIFIC/TECHNICAL PROJECT RESULTS

VirtuAAL project's achievements and progress towards objectives are in line with the DoW for the technical work plan, the business model development and the goals and planned results that have been reached within the project. End-user related work and preparation of field trials also were on time and no delays appeared during the project.

All the partners worked well in terms of adding value to the project. This was a complementary consortium and the roles were clearly defined:

● IDE: as the coordinator, has been working in the coordination of all the work packages and deliverables. Apart from that, has been the technical development of the final solution and has worked with the other partners in defining the business plan for the resulting solution.

● DEU has defined the plan for the pilots, the KPIs and data that should be collected during the tests. Apart from that, with the information reported by the end-users have prepared the conclusions shown in the "D2.2. Dashboards and KPI Performances" deliverable.

● CAT and ANA have made the first lab tests on the platform to send suggestions to IDE for the final pilots. And have selected the involved stakeholders in the different tests, sending all the information to DEU and creating the" D2.3. Qualitative final evaluation and recommendations for further improvement" deliverable.

● CAT also collaborated with IDE in offering and preparing all the devices for making live demos of VirtuAAL during the AAL Forum in IDE's booth.

In terms of the tested technology, the most important conclusions are:

● We do not think the Augmented Reality game is relevant for Final Trial, as it is in its current state does not seem fit for cognitive training.

● The Oculus Go game is similar to the kitchen game in the HTC VIVE platform but is generally easier to use and less interactive. In Denmark, it was not considered meaningful to test both platforms on the same users throughout the Final Trial, as the games are very similar, and the therapists and initial users have found the HTC VIVE platform much more suited for training purposes. In Romania, primary end-users tested and trained on both platforms during the Final Trial and they gave feedback about both (as in the Lab Testing initial end-users showed interest for both devices). After their first Final Trial session, primary-end users from Romania preferred Oculus over HTC Vive, however, this preference moved towards HTC Vive after the last Final Trial session.

 Oculus could be interesting, it the product evolves, for end-users with less mobility.

● So the final recommendation is that the combination of HTC VIVE glasses and Leap motion was the most successful for the end-users and caregivers and that it will be the base of the Kwido VirtuAAL commercial product.

The defined KPIs created for the beginning of the project were successfully achieved.

Key Performance Indicators:

● Achieving 40 testers

- General satisfaction level (as measured by SUS): Yes
- Balanced gender distribution in testers: Yes
- Creation of 3 usable and entertaining games for virtual reality with positive feedback in the tests: Yes
- Completion of the test phase with all the tests passed:Yes

The resulting product already includes different games, and the ones for HTC have been the most intensively tested so, after some debugging, they would be ready for the market. Apart from that, the VirtuAAL platform has already been integrated into the existing Kwido Mementia backend. This way, IDE is now able to offer a product that can combine:

- The VR games for cognitive stimulation using the VirtuAAL platform.

- The serious games from Kwido Mementia for cognitive stimulation on tablets, touchscreens and computers.

- The algorithm in Kwido Mementia has been adapted to receive the performance of the end-users while playing also VR games in order to add this info to the analysis of the possible cognitive impairment of the patient.

Some conclusions:

- Almost every user did not feel any dizziness neither during the games neither after them.
- The best opinions have been assigned to the "shapes" game, in which the users put the objects in holes depending on colors and shapes.
- As a general set of conclusions, it can be said that the games have been fairly popular and are to be ready to enter the commercialization phase just after a few changes especially related to lighting, sound and level of difficulty.

3 B. PROJECT RESULTS – BUSINESS MODELS & END USERS INDICATORS

BUSINESS MODEL

Until now, cognitive stimulation platforms were oriented to their usage in daily centers and nursing homes as these therapies were been managed by therapists manually due to the lack of accessible and scalable software platforms. When talking about technical platforms, touchscreens and tablets with serious games are the only options for these end-users. Even Ideable, has already launched its own platform for combating cognitive stimulation using games, called Kwido Mementia.

And regarding VR & AR and its use in elderly patients, most of the initiatives are focused on physical rehabilitation or subjects outside cognitive impairment.

The values of VirtuAAL:

•   A totally immersive and accessible experience for elderly patients using the combination of HTC VIVE glasses and Leap Motion.

•   The therapies are focused on cognitive stimulation training and the detection of possible cognitive impairment.

•   VirtuAAL also includes the possibility of working in daily activities.

•   VirtuAAL already links to a cognitive stimulation platform that includes also training with serious games on touchscreens, tablets and computers.

Our value: A new disruptive and motivating platform to combat cognitive impairment using VR. These new technologies have a significant impact on the motivation of the end-users, apart from helping them preventing possible cognitive impairment problems. It's also interesting that they may perform tasks in daily activities.

Business plan for IDE as the commercial responsible for Kwido VirtuAAL (the resulting trademark after the project):

•   Value Proposition: A new disruptive and motivating platform to combat cognitive impairment using VR.

•   Customer segments: Eldercare companies, Public & private eldercare & healthcare services, rehabilitation institutions.

•   Distribution channels: Eldercare and healthcare publications and fairs, Eldercare influencers, AAL, EIP on AHA, Online marketing / SEO and Web & Social media platforms

•   Revenues streams: Pay per use (depending on contracted services) and consultation fees. Optional renting for hardware. SaaS model.

•   Key Resources: Experience from caregivers & other stakeholders, Software developers, Marketing & Sales experts.

•   Key activities: Adaptation of previously developed games, co-creation, consultancy and support, demonstration and experimentation, engagement.

- Partners and alliances: Partnerships in specialized networks like Elderly users & associations, Eldercare partners, EIP on AHA, EnOLL (European Network of Living Labs) or Eurocities (alliance cities).
- Cost structure: Personnel, real-life deployments, equipment, travels, marketing activities, a platform for administrators, renting fees.
- Time to market: It's planned to launch virtuAAL before the end of this year.

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The targeted market is the B2B market for cognitive stimulation in the European daily centers, nursing homes and memory units. Regarding cognitive impairment, dementia and related neurological conditions affect 10% of people aged 65 plus. In people aged over 85, around 50% have some form of cognitive impairment ranging from mild to severe dementia. The number of cognitively impaired people. About 46,8 million people were affected by dementia worldwide (10,5 million in Europe) and in 2050 they will be 131 million (18,7 million in Europe).

Apart from following the GDPR regulations when implementing and selling the solution, we don't expect to find extra certifications for reaching the market.

During the next 3 months after the end of the project IDE will test new games with our usual collaborators and will solve the pending bugs detected by CAT and ANA during the pilots.

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END USERS

During the project, we identified the next groups of users:
-       i) Primary users: elderly people in a different environment; living labs and nursing homes. Grouped by age, gender and IT-intensive use level. Also, there will be segmentation by age and gender group to evaluate the adoption of security policies and proactivity to behavioral changes, an important variable for a rapid take-up.
-       ii) Secondary users: the caregivers, i.e. psychologists, caregivers, therapists as well as businesses are pooled as the secondary users
-       iii) Tertiary users: nursing homes, daily centers and memory units that will be the potential customers of the solution.

And for the pilots, this is the main description of the end-users involved in each case.

For the pilots done by CAT in Denmark, a total of 22 primary end-users from Denmark was involved in the Final Trials. Of the 22 involved primary end-users 13 were female and 9 were men. The average age of the end-users who participated in Denmark was 74,5 years old. The youngest participant was 60 years old and the oldest was 96 years old. The end-users were primarily people living in Aarhus either alone or together with their spouse, a few users were living together with relatives. Most of the participants were wheelchair users (17) and had low mobility. For this reason, all users were either placed in a supportive chair or using their own wheelchair when playing. The cognitive level of the primary end-users was scored using the MoCA test, which is normally used as a screening tool for many illnesses related to cognitive decline. The average MoCA score for the end-users who participated in Denmark was 20,7. The educational level of the end-users was divided into 5 different categories: Primary school (27 %), Professional school (14 %), Superior studies (university) (36 %), Post-university studies (9 %) and other (14 %). All users from CAT was undergoing rehabilitation program and participated in cognitive or physical rehabilitation several times a week.
A total of three secondary end-users (occupational therapists) from Denmark was involved in the Final Trials. The secondary end-users were in charge for each cognitive training session with the Kwido VR system.

For the pilots done by ANA in Romania, A total of 33 primary end users from Romania were involved in the Final Trial from 35 that subscribed (2 were excluded). Of the 33 involved primary end-users 25 were female and 8 were men.
The end-users were autonomous elderly living in Bucharest or close to Bucharest.
Most of them had an active living and they were involved in many activities in the Senior's Clubs (as some of them described: photography courses, language courses, dancing, singing, theater playing , physical exercises, playing strategy games and socializing).
The participants had no major mobility problems.
The average age of the primary end users who participated in VirtuAAL project- Romania was 73,4 years old. The youngest participant was 63 years and 5 month at the beginning of the Final Trial and the oldest was 85 years old.

Their living status and educational level was as shown bellow:
 41,9% were living alone and the rest of them with at list one family member.
 51,6 % from the participants had superior studies (university), 19,4% post-universitary studies, 3,2% high school and post high school studies, 6,5% high school (13 years of schooling), 9,7% high school (12 years of schooling), 3,2% gymnasium (8 years of schooling).

The cognitive level of all primary end users was screened in the beginning using the MoCA test (Montreal Cognitive Assessment). The lowest MoCa score was 20 points out of 30 and the highest score was 30 points out of 30. Accordingly to the MoCa scores, the end users from Romania had either a normal cognition or a mild cognitive impairment present.
The mood of 30 out 33 primary end-users was screened in the beginning using the Geriatric Depression Scale (GDS) -15 items - a screening tool used to identify depression in older adults. 20 of the participants had GDS scores less than 5 points out 15 points (no depression), 9 had scores between 5-8 points out of 15 (indicates mild depression) and 1 had a score of 9 points out of 30 (a score between 9 and 11 can indicate a moderate depression). No severe depression was signaled among the participants accordingly to GDS.

A total of 2 tertiary end-users (2 Senior's Club Coordinators) were involved in the VirtuAAl Project in Romania (as they were a support for the dissemination of the project among the elderly from the Clubs and as support during the project).

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3 D. PROJECT RESULTS – OTHER INDICATORS	
Patents, which are the direct result of the project work	N/A
Contribution to **standards**, which are the direct result from the project work	The games developed under Unity for HTC Vive, Oculus and AR and its integration with the Kwido Mementia platform are the direct results of the project. No contribution to standards were made during VirtuAAL.
Publications (scientific or other), which are the direct result from the project work (please provide details)	
Other **dissemination activities**	6 posts in the webpage 8 tweets in Twitter 7 publications in LinkedIn Kwido VR platform present in Dokk1 in Denmark June - December 2019 A presentation in Lisbon to Santa Casa da Misericordia during May. Presentation during AAL Forum 2019 in Aarhus. 23th of September Presentation to French ICT clusters the first week of October.
Type and size of audience reached by dissemination activities	Around 500 possible partners and clients attended our different presentations. Around 53 people accessed the webpage during the last month. Around 3,800 impressions of our tweets in Twitter. Around 470 impressions of our LinkedIn publications.

4. FINANCIAL INFORMATION - OTHER COMMENTS

Please check appropriate box:
The financial part of the project **X** *is in line with (or)* ☐ *deviates from the partner's Grant*

Agreements & Work Packages plans (personal efforts, other costs, etc.)**?**

In case of deviation, please give a short explanation:
No deviation during the project

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Other comments related to financial part of the project:
N/A

5. AAL JP PROGRAMME

Please comment, using your AAL project experience, on the main advantages and disadvantages of AALJP projects.

The AAL-JP projects allows the realization of ideas concerning the needs of apps for older people by bringing together knowledge and expertise from different European countries. Further, the combination of different kind of organizations (research institutions, SMEs and end-user organizations) brought diverse aspects into our consortium and was beneficial for VirtuAAL. Besides benefits which come from a large and diverse consortium one has to keep in mind the coordination challenges. We think that it is important that AAL-JP focuses on end-user integration. In VirtuAAL the integration of real users was crucial for its success. Business development is often underestimated, but from our point of view it is important to think about the market right at the beginning of the project, especially in small collaborative projects. Now, the challenge is to scale the project at the European level and analyze in-depth that there is an impact of virtual reality in the fight against cognitive impairment in the elderly, not only that it increases their motivation as well. First good news is that we have a great feedback from the market before ending the project and that even a first client (Santa Casa da Misericordia in Lisbon) will use it in the beginning of 2020.

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	6. UPDATED PROJECT PARTNERS' CONTACT DETAILS[1]				
NO.	**PARTNER ORGANISATION NAME**	**CONTACT PERSON**		**EMAIL ADDRESS**	**TELEPHONE NUMBER**
		NAME	**LAST NAME**		
1 (coord.)	Ideable Solutions, SL	Jose Ignacio	Bartolome	ibartolome@ideable.net	+34 946414447
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3	Center for Assisted Living Technology, Health and Care, Aarhus Municipality	Sonja	Hansen	sonha@aarhus.dk	+45 41872596
4	University of Deusto, eVIDA	Begoña	Garcia	mbgarciazapi@deusto.es	+ 34 94 413 93 78

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[1] Please insert here, for every partner organization participating in your consortium, the updated email address and telephone number of the main contact person. These persons might be contacted after the closure of the project for statistical enquiries related to impact assessment.