COMPETITIVENESS AND INNOVATION FRAMEWORK PROGRAMME

ICT PSP call for proposals 2008 - ICT PSP/2008/1

Project acronym: **Long Lasting Memories**

Project Number: **238904**

Project Type: **Pilot Type B**

Project full title: **Long Lasting Memories**

ICT PSP Main Theme addressed: **1.4: ICT for ageing well with cognitive problems, combining assistive and independent living technologies**

TECHNICAL ANNEX – "Description of Work"

Number and Date of preparation: v3.1 of 07/04/2009 – accepted on 10/_04/2009

List of participants:

1	ARISTOTELIO PANEPISTIMIO THESSALONIKIS / Medical School	AUTH	Greece
2	UNIVERSITAT KONSTANZ	UKON	Germany
3	ATHENA RESEARCH AND INNOVATION CENTER IN INFORMATION COMMUNICATION & KNOWLEDGE TECHNOLOGIES/ Institute for Language and Speech Processing	ATHENA RC	Greece
4	Tero Ltd	Tero	Greece
5	CEIT RALTEC gemeinnuetzige GmbH	RALTEC	Austria
6	INVESTIGACION Y DESARROLLO INFORMATICO EIKON SL	EIKON	Spain
7	Fundacion INTRAS	INTRAS	Spain
8	E-SENIORS: INITIATION DES SENIORS AUX NTIC ASSOCIATION	E-SENIORS	France
9	GLOBAL SECURITY INTELLIGENCE LIMITED	GSI	UK
10	GENIKO NOSOKOMEIO ATHINAS IPPOKRATEIO / Health Centre Vyronas	IGNA	Greece
11	Milton Keynes Council	MKC	UK

B1. Project description and objectives

B1.1. Project Description

B1.1.1 Concept

The Long Lasting Memories consortium will develop a service that can provide senior citizens greater support towards their independent living. Long Lasting Memories will offer support not only to elderly people but also to their relatives and families. Apart from providing monitoring of day-to-day activities of senior citizens and identifying imminent hazards, the Long Lasting Memories service will most importantly increase their self-esteem and alleviate symptoms relevant to cognitive degeneration. It will thus facilitate their interaction with society and thus alleviate their loneliness and potential depression. The ultimate goal is to enable the elderly portion of the European population to live and work in their desired habitat.

Long Lasting Memories will be tested in real life situations in order for a consolidated set of requirements and validated functional specifications to emerge as a result of the project. To achieve consistency of requirements and specifications across the whole value chain, the consortium contains a multidisciplinary team of partners encompassing all spectrum of technology to end service providers, and including public authorities from each country that have responsibilities and budget control in the relevant area of care or supply of services.

The Long Lasting Memories consortium will intensively work out social and user-centric aspects of ICT and ageing and Independent Living services in order to implement a platform that will be easily accessible, widely available, and affordable for the end-users and their care providers. The Long Lasting Memories consortium will evaluate this platform through appropriate trials so as to validate its practical, supportive, and cost-effective characteristics.

A substantial and high-profile contribution to the European e-Inclusion Initiative and the i2010 flagship on ICT & ageing can then be achieved through Long Lasting Memories.

The Long lasting memories service can become a systemic solution for independent living and active ageing, including mobility aspects and reorganization of integrated care processes, leading to a significant prolongation of personal autonomy and participation in society across prevailing age-related impairments. Furthermore, the open reference architecture of its training component will enable its application to a wide spectrum of available ICT & ageing supporting solutions and environments, enabling its seamless integration and plug-and play operation with available sensors, devices, sub-systems and integrated care services, thus leading to a cost effective, reliable, privacy-respecting and trusted service for cognitive training.

B1.1.2 Background: state of the art in ICT solutions for the elderly

Substantial advances have been made over recent years in applying technology to meet the needs of older people. In parallel and in accordance with e-Health solutions, the field of Ambient-Assisted Living (AAL) has been developed, aiming on alleviating the difficulties of every day life for the elderly or people with disabilities in general. Taking into account the increasing number of elderly population in Europe and the identification of its subsequent social and financial consequences, national and European research efforts have focused on such independent living solutions, trying to make an edge on this quickly arising and expanding market. Condition observation of the senior person and notification in case of an emergency, comprise the most common features of such systems. This offers a sense of safety and reassurance to the elders themselves and their relatives that they will receive the care required in a time of need, without having to be succumbed to intensive care.

AttentiaNet and Seniority comprise two already completed projects which aim at improving the quality of assistance and hence quality of life of elder people in Europe by utilizing advanced technologies for telemonitoring and telecommunications. A different approach is followed by MobilAlarm which enables older people to initiate an alarm call whenever and wherever they need to do so (using GPS; mobile telephony; body-worn alarm devices; service centres; geographic localisation and alerting software). More recently, a number of solutions have been proposed that utilize various sensor networks, from audio and movement to micro- and nano-sensors hand, to detect common elderly accidents, like falls. Projects Netcarity, INHOME, EMERGE and OLDES fall under this category. Another, more recently proposed perspective for a solution to the same problem is offered by projects like Confidence and SMILING or that utilize wearable tags and non-invasive systems to detect mobility problems and provide a sense of security in the Third Age. Finally, the R&D project called Companionable, which is still in its initial stages, will try to synergistically combine the strengths of a mobile robotic companion with the advantages of a stationary smart home, improving the elder person's interaction with the system as well as the care itself.

Besides AAL systems, a second dimension has been introduced in the field of ICT solutions for the elderly, comprising of the systems that aim on compensating for their cognitive decline. In accordance with mainstream e-Inclusion targets, this approach's objective is to retain elderly people socially active and more self-reliant for a wider period of time. An example of such projects is VM (Vital Mind), which provides cognitive training by using related psychology, a TV-set and advanced ICT. The reasoning of VM is to enable elders to exercise actively and autonomously in front of the familiar to them television medium. On the other hand, the FP7 HERMES project aims at providing an integrated approach to cognitive care, based on assistive technology that reduces age-related decline of cognitive capabilities. HERMES offers cognitive training through games, while also supporting them in indoor as well as outdoor environments, when necessary. Support for elderly people with cognitive disabilities, and especially mild dementia and Alzheimer's disease, is provided by COGKNOW which aims to develop a cognitive prosthetic device which will help elder "navigate through their day". Functionalities like reminders and support for communication and anomaly detections are planned to deliver this promise.

Though several other categories for applications for the elderly can be identified like mobility aids or medical implants, the aforementioned ones are those more closely related to the **LLM** service. Nevertheless, they constitute subcategories of it, since as will be presented in the following chapter, LLM aims at providing cognitive training whilst monitoring the physical well-being of its users. In this respect, it integrates existing partial approaches into a unified innovative ICT solution.

B1.1.3 Long Lasting Memories service

The **LLM** project aims to deliver an integrated ICT solution that will provide cognitive and physical training for elderly people inside the framework and safety of an assisted living environment. The service will be installed in homes and institutions and will ensure the accident-free, personalized and monitored corporal and mental training of its users. Meanwhile, users will be able to take advantage of the features of an independent living solution. This will be accomplished by home automations that will compensate for the disabilities of people with cognitive problems or mild dementia during their daily activities. Finally, an elaborate distributed sensor network will guarantee immediate response in case of an emergency, by calling for help through public telephone lines. In this respect, LLM aims at a unified solution that will combine independent living solutions with cognitive and physical training, according to recent research claims on the effectiveness of moto-sensory training on senior citizens with cognitive problems or mild dementia.

Extensive research on this topic has proven that sensory training is one of the most effective countermeasures against cognitive deterioration and mild dementia. Furthermore, corporal

activation is a well acknowledged factor of healthy living, having significant positive effects in the physical well-being of people. Finally, moto-sensory training, which makes use of the unified LLM environment, provides a third way of mental stimulation, thus creating a comprehensive training system for the elderly.

The LLM service regards assistance at home for the elderly (independent living solution), while providing cognitive and physical training according to a personalized training program. This approach renders LLM an innovative ICT solution for ageing well, featuring typical AAL solution characteristics, like accident detection, support in daily activities and third party notification in case of emergency, and combining them with preemptive measures like training.

To accommodate the deliverance of these services LLM system utilizes state-of-the-art hardware and software technology. It comprises of:

- User Interfaces: touch screens or simple screens for interaction with the users. All system functionalities, including home environment management, cognitive training and physical exercising performance monitoring, are displayed and set from the Local User Interface, which is a touch screen. Remote User Interfaces for communicating with the relatives, care takers or authorities in the case of an emergency.

- Sensors: to monitor movements inside the house. They are deployed as a distributed network of wirelessly connected sensors that identify moving patterns and detect deviations from those patterns or falls. In these cases they notify the user's relatives or caretakers via the Remote User Interface.

- Facility to connect Instrumented Power Outlets: which are sensors measuring voltage and current (power) fed into appliances. These sensors detect of forgotten switched on electrical appliances.

- Both aforementioned sensor components guarantee the safe living of the elderly inside their home environments without need for exclusive intensive care.

- Facility to connect Actuators: which facilitate acts like opening windows, doors and blinds and are remotely operated with the Local User Interface. These provide the daily activity supporting feature of the LLM service.

- Processing units: an embedded processor and a general purpose PC which are used for coordinating and management of the AAL environment, for executing the cognitive training software and for storing and processing the physical training performance information. The cognitive training software that will be initially used will be the BrainFitness of PositScience. Subsequently, different cognitive training software packets will be used.

BrainFitness was selected at this stage as it is considered state-of-the-art product in the United States and has already been translated by partner UKON in German, a first step to a wider deployment of the software in Europe. The Brain Fitness Program is designed to speed up auditory processing, improve working memory, and encourage the brain to produce more of the chemicals that help it remember. Having already acquired the endorsement of PositScience and following a cooperation formula that will be further elaborated during proposal implementation, our consortium will organize and hold the pilots using the BrainFitness software. Cognitive exercises provided by it are divided into six categories, bearing different cognitive impacts to the service's users.

- High or low: In this exercise, subjects hear sweep sounds and have to identify whether these sounds are rising or falling in their frequency (purpose: training basic sensory temporal discrimination)
- Frequency discrimination: Two pairs of sounds are presented. 3 sounds are identical; one sound is deviant in frequency. The subjects have to decide in which pair the deviant sound occurred. (purpose: training basic frequency discrimination)
- Tell us apart: In this exercise, subjects have to tell apart two similar phonemes, which might be difficult to understand because they are specially synthesized. (purpose: training speech relevant sounds by using specifically processed challenging speech sounds).
- Sound replay: The subjects hear several syllables and have to remember them. They have to repeat them in the right order by pressing the corresponding buttons. (purpose: trains longer syllables and auditory short-term memory)
- Match it: In this exercise, subjects have to press on rectangular buttons to hear syllables. The goal is to find two buttons that represent the same syllables and click on them one after the other so that they disappear. (purpose: uses longer syllables and trains auditory memory with visual components).
- Storyteller: Subjects hear segments of stories and are asked to answer a set of questions concerning the details of the respective segment. (purpose: uses whole words/sentences and trains story comprehension and memory)

Various training equipment like recumbent bikes and/or ergometers and/or treadmills, which offer a variety of physical exercising possibilities according to the special needs and disabilities of each user.

Recumbent bikes are the most suitable apparatuses for elder users with moderate disabilities. Allowing them to remain in the designated position on the specifically designed chair, well stabilized by the back of the seat and the side handles, enables the elderly to exercise to the extent required without being afraid of falling. Meanwhile, the users may interrupt the exercising procedure at any point without any risks.
For people in a more serious condition ergometers might be used, as they require minimum physical exertion and can be used in normal sitting position.

On the other hand elders in better shape or of a younger age may use treadmills, simulating a walk they would do outside, within the eHome framework. Besides all treadmill built-in safety mearures (like instant stop of the runway's movement upon the draw of a cord), LLM service users will feel even more secure due to the eHome monitoring system, which will respond immediately in the case of an emergency. Each of these training methods will be coordinated by the central management system to follow a specific training program, according to the each users abilities and special needs. Motivation messages and performance indicators will appear on the Local User Interface of the system, thus informing the user of his or her progress and adjusting his personal training program accordingly.

Figure 1 shows in a simplified manner the LLM service:

A notebook or PC with touch screen is the central element for the end user. It offers to the end user an intuitive, simple to use graphical interface for interaction with the cognitive training system, the physical training system and the independent living component. with simple operations (touching on a soft button) accessing the 3 different integrated components is possible.

The PC runs the cognitive training system and provides simple access to the wireless sensor system which is monitoring activities and movements of the end user and generates an alarm in case of detected emergency situations. Additionally it monitors the usage of the physical training components.

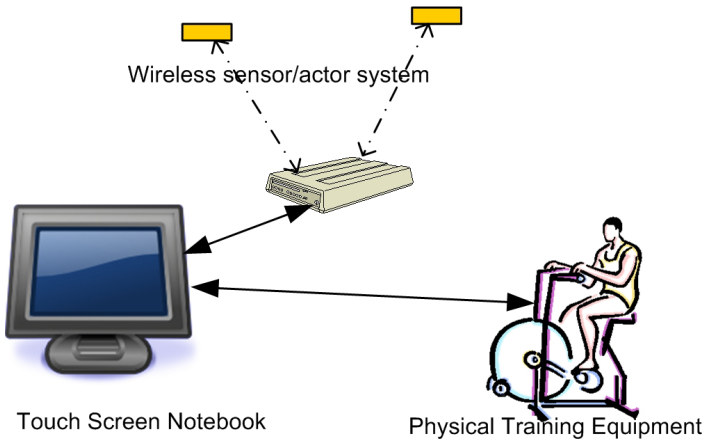

Figure 1: LLM service description

Efforts will be undertaken during LLM so as to integrate the different (existing) physical subsystems of the project, namely, the the Independent Living Component (ILC), the Cognitive Training Component (CTC) and the Physical Training Component (PTC). For this to be properly done, one needs each component to be able to sufficiently communicate with the others in a standardised (as much as possibly achievable) way. A reasonable solution to this end may be the use of XML in the description of each subsystem and the exchange of important information. Possible starting schemata for such integration will be provided below in other relevant sections.

B1.1.4 Envisaged usage of the service

The **LLM** service is designed to provide its features to elderly people living at home, staying at day care centres or being hospitalized in a simple user-friendly way. Though these three categories significantly differ from one another they can all utilize the **LLM** platform, by gaining different benefits each time. Each of these three cases is described with examples below:

A. Elderly remaining at home

Mrs B. is an old lady who has recently widowed and is now living in the same town as her daughter. Nevertheless there is such a distance between them that forbids her child to constantly visiting her and seeing if everything is alright. While this distance arrangement has successfully worked while Mr. B was alive, after his death, Mrs B's daughter finds herself worrying more intensely about her mother, afraid that she might fall at any time, without having someone to help her. She is thinking about hiring a personal caretaker, but knows that her mother will not accept full time care. Finally, her mother is already showing some signs of memory loss, a definite sign of cognitive decline.

LLM can be used in such or a similar scenario very effectively. First of all, it would be easier for Mrs B. to accept having around, since it would be less obtrusive than a home personal caretaker. Meanwhile, the eHome environment would monitor the movements of Mrs B. and notify her daughter at home or at her mobile if anything went wrong. Thirdly, it would create a training programme for Mrs B. following the pattern for an aged person in moderate condition and motivate her to work out mentally with BrainFitness (or any other cognitive training software) and on the physical training equipment, which for the case of Mrs B. would be a recumbent bike.

The usage of the service would go along these lines: Mrs B. wakes up. After washing up, she approaches the touch screen of the LUI of eHome and selects to automatically raise up the blind from her windows. She sits then on her armchair and clicks on the touch screen to initiate the cognitive training procedure. A number of exercises appear on the touch screen and Mrs B. clicks

on the correct answer by putting her finger on the corresponding button-image on the screen. At any time she can stop the procedure by clicking on the corresponding button; otherwise the procedure will eventually finish for this day, asking her to return tomorrow. During the evening the system suggests her to sit on the recumbent bike and follow the training program according to the displays on the screen. Since Mrs B. has improved during the last two weeks the program will set a slightly more challenging physical program and monitor her performance. If she can keep up with the pace then after two weeks a more intense work out will be proposed. Otherwise, the system will return to the previous pace and will display related messages accordingly.

The effects on the lives of Mrs B. and her daughter are various. First of all Mrs B. her self feels more self-reliant and independent, not only because she can move freely around the house without any worries, but also because she is feeling physically and mentally fit. Furthermore, her daughter is not afraid about her mother being helpless, since she knows that in the case of an emergency the system will immediately notify her. Finally, on a less important -but still worth mentioning- level, her family has saved a lot of money first of all by not hiring someone for exclusive 24 hour care but also by prolonging the cognitive and physical well-being of Mrs B and thus postponing any intensive care or hospitalization needs.

B. Elderly day care centres

The day care centre for the elderly in a small town is a nice and clean place where aged people can spend their talking to each other, playing games and generally entertaining themselves. However, the number of elderly people in the centre and subsequently of the ones with mild dementia or more serious cognitive disabilities has risen over the years. Consequently, the care centre's staff does not have adequate time to spend on each person while the increased number of people with cognitive deterioration makes the situation even worse. Relatives are contacted and are asked to provide exclusive care to their parents, while the manager of the centre believes that more stuff is needed but cannot be afforded.

LLM could be used in medium and large size elderly care centres, because it provides an interesting way to keep the elderly occupied, while improving their mental and physical condition. In this respect, we envision that a day care centre using **LLM** would have an eHome installation and in a specific purpose room the touch screen and all physical training equipment. In this case, more than one apparatuses could be used, in order to provide different levels of exertion according to the user's abilities. The elders would enter the room, sit on the armchair and use on or more touch screens to access the cognitive training software. Meanwhile, they would work out on the equipment of their choosing watching their performance on the screens and remaining fit for a longer period of time. Finally, if any accident were to occur inside the eHome framework, the centre's staff would be immediately notified to urge to the place of the accident.

This advanced installation offers an added value to the day care centre, by prolonging, through the training process, the time that elders remain in a mental and physical condition that allows them to interact or at least coexist with other people, without the need for more intensive personalized care. This results into them being able to visit the day care centre for a longer period of time improving their own quality of lives but also the revenues of the care centre. Moreover, the staff should not be linearly proportional to the number of day care centre visitors since the monitoring system would take care that immediate action would be taken if an accident occurred.

C. Clinics for the elderly

If an elder is hospitalized it means that he or she is in need of more intensive care. Nevertheless, many such places allow the elders to move freely around its facilities, provided of course that they have the required mobility skills. Much like as at the day care centres, constant monitoring of their moves is not possible. Meanwhile, though most clinics provide physiotherapy sessions, they lack of any methods for cognitive training.

LLM could be used in its extended installation for elderly clinics, providing a sensor network all over the place and moreover including at the clinic's facilities special rooms for the cognitive training of the hospitalized. Meanwhile, the physical training equipment could be used complementary to the normal physiotherapy sessions of the elderly. The **LLM** service would first and foremost be used by the hospital's staff to know whether any of their patients has had an accident, so as to take care of him or her immediately. Moreover, the elders would visit the cognitive training rooms and use the BrainFitness software to stimulate their mental functionality. For maximum effect, the clinic could have a specially trained neuropsychologist to evaluate each patient's progress in parallel with the **LLM** system and provide further feedback in the form of personal interviews. Finally, patients whose physical condition allows them to do that, could be encouraged by the hospital's staff to use the physical training equipment, following the system's motivational advice. This complementary training would further increase the mobility skills and improve the physical well-being of the patients.

Taking into account that hospitalized persons suffer either from a cognitive and/or a physical related problem, **LLM** could have a tremendous effect on each different group. Its cognitive training component could be used by every patient, with the only exception those with severe cognitive malfunction. On the other hand, this group could make use of the physical training equipment, thus improving its freedom of movement. Meanwhile, patients in a milder situation could benefit from both components, while all three aforementioned groups would enjoy freedom of movement within the hospitals premises due to the monitoring system of eHome.

B1.1.5 Integration of the different sub-systems/components

A possible integration scenario that may be utilised to put the aforementioned LLM service descriptions under a common umbrella (and following the integration notion provided earlier) is illustrated in the figure below:

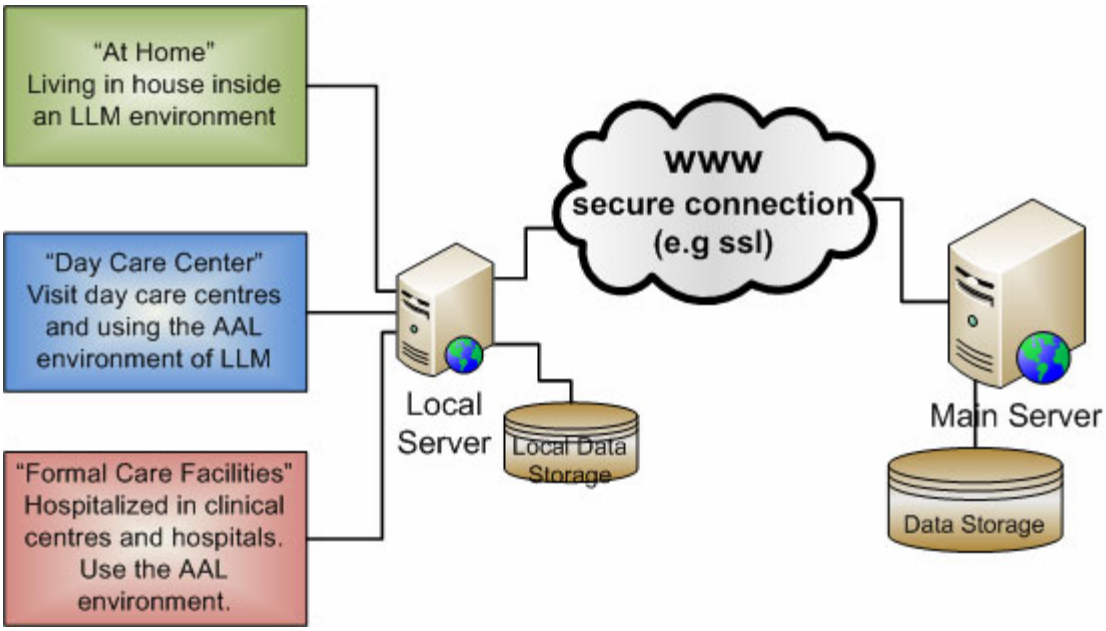

Figure 2: Integration scheme for the LLM services

Following these three envisioned usage scenarios, our business plan involves promoting three respective solutions in different scale (and consequent cost) to effectively cover each of those cases.

B1.2. Project objectives

The strategic objective of the **LLM** project is to integrate two existing ICT solutions with physical training equipment, thus delivering an innovative system for ageing well and validating the resulting service in various sites all over the EU. The reasoning behind our project is our belief that a unified solution of different components from ambient-assisted living and selft-training will be able to surpass existing unilateral approaches. Piloting this service at a European scale with the aid of the CIP funding, will comprise the pole on which the **LLM** consortium can step to reach a wider market and aim for extensive service deployment.

We are planning on validating the efficiency of our service, promoting and disseminating its results by holding pilots in five EU member countries: Austria, France, Greece, Spain and UK.. The people that will be directly affected by our pilots will be:

- The ones living at their houses inside an **LLM** environment, utilizing its AAL and training services ("At Home" installation)
- The ones visiting day care centres and using the AAL environment of **LLM**. Optionally, they might use the training components as well ("Day care centre" installations)
- The ones being hospitalized in clinical centres and hospitals. They use the AAL environment, while following the cognitive training and using the physical training component as complementary to their physiotherapy sessions.

As indirectly affected we count end-users (elders and their relatives) that find out about the **LLM** service or watch it being applied to others. In this respect, we anticipate that all residents inside a care or clinical centre will be affected by the pilot trial there: either directly or indirectly. Furthermore, we remind here that all pilots will be iterated in four phases, a fact which increases the number of implicated users. Moreover, as the profile of users addressed in **LLM** includes not only end users but also providers of services supporting the end users, in most of the cases "professionals" that act as de facto "prescriptors" of the service and public administrations promoting and backing PPPs (public-private-partnerships) and funding initiatives under the corresponding National Programmes, in the planned pilots we will try to include all of them in order not to miss any important feedback.

The overall project objective can be broken down in the following underlying objectives, described on the table below:

Objective Nº	BRIEF DESCRIPTION
O1	Integrate two existing ICT solutions with physical training equipment, thus delivering innovative ageing well / independent-living support services for elders
O2	Demonstrating the significant impact potential of **LLM** service in five different countries
O3	Verify the technical, organisational and legal feasibility of **LLM** service along the complete value chain of stakeholders
O4	Verify the sustainability, scalability and applicability of **LLM** services across Europe

Table 1: LLM underlined objectives

B1.4. Maturity of the technical solution

The **LLM** service will provide its innovative service by integrating two existing successful ICT solutions with custom training equipment, along the lines of the CIP work programme, which accepts proposing the market validation of non-existing systems that can be created by the merging of existing partial solutions. Of course, one prerequisite for such a service is to demonstrate significant impact potential according to the specific objective of the work programme. As explained in chapter B2.1 of this report, we believe that the **LLM** service complies perfectly with the target objectives of the 1.4 objective for the CIP programme, and therefore its integration process will be worth as it will result into a really relevant innovative ICT solution.

In this respect, the **LLM** does not currently exist. However, as it has already been explicated, the **LLM** service will be based on existing partial solutions. More specifically the system is designed to comprise of three existing interoperable components which perform complementary and interactive tasks to provide the system's services:

- the Independent Living Component (ILC)
- the Cognitive Training Component (CTC)
- the Physical Training Component (PTC)

The ILC and CTC Components do already exist offering independent living and cognitive training solutions through the use of ICT. As for the PTC, since it comprises of regular home training equipment, it can be roughly described as an ICT solution, but more as another component that will be further integrated to the delivered system to provide additional features to the **LLM** service.

B1.4.1 Independent Living Component (ILC)

The ILC is based on the eHome system, which is comprised of a network of distributed wirelessly operating sensors connected to an embedded system (the e-Home central unit). It includes features such as intelligent learning of normal and exceptional patterns of behaviour (dangerous situations or indicators for emerging health or social problems), raising of alarms and as an optionality controlling of elements which are typical for a smart-home environment.

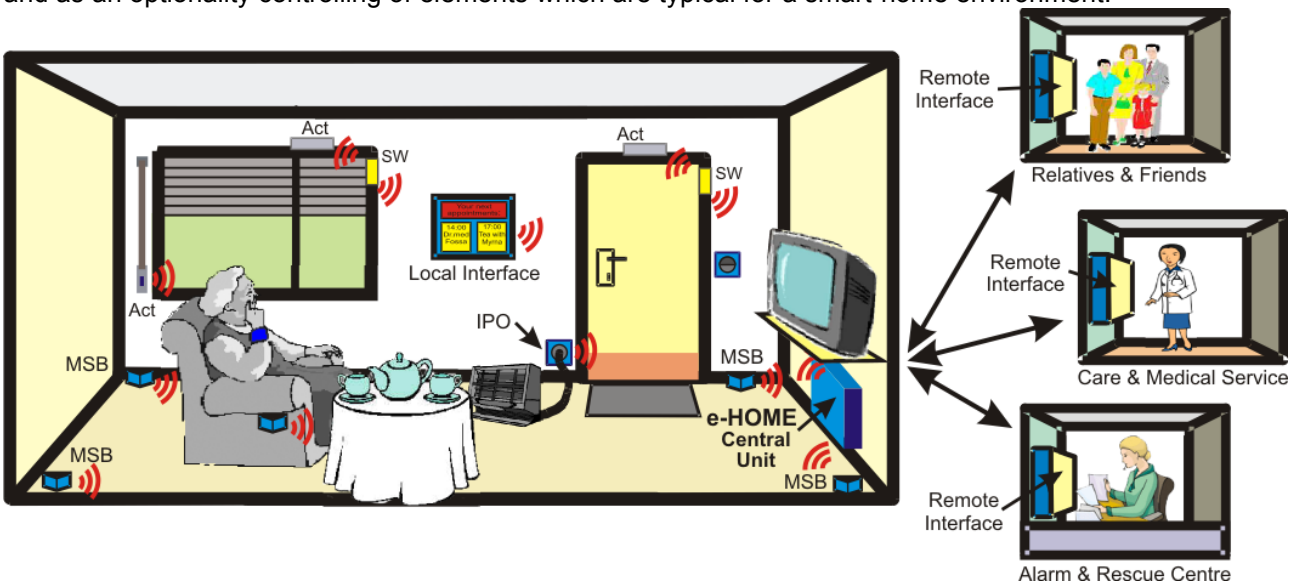

Figure 3: Typical installation of an e-HOME System and its components

- User Interfaces: Local Interface and Remote Interfaces (on a PC or sent to a cell-phone).
- Sensors: MSB: Multi-Sensor-Box (sensor cluster), SW: Simple on/off switch,
- Facility to connect Actuators: Act: e.g. for moving blinds, door opener, window opener
- Facility to connect Sens+Act IPO: Instrumented Power Outlet (sensors for voltage and current, remote switch)
- Home Control Unit: (e-HCU) (eHome information processing)
- Connection from Local to Remote Interface over broadband

Around the embedded system forming the e-HOME-Central-Unit (e-HCU) which is managing the sensor and actuator network and carrying out the inference-drawing, two user tailored multi-modal interfaces, one for local and one for remote interaction with the system are provided for the inhabitants, the relatives, as well as for formal and informal carers.

For financial reasons the sensor network mainly consists of modules which contain a whole set of sensors connected to an embedded processor and a wireless communication unit. The sensors that are working together in a “Multi-Sensor-Box” (MSB) are:

- Temperature sensors
- Accelerometers to detect movements and vibrations (one to three axes)
- Reed-Switches (work together with a magnet)
- Facility to connect Illumination detectors for measuring the ambient light level

Every MSB-unit containing an embedded microprocessor collects the sensor readings, performs a low level signal analysis and data compression and transmits the coded and time-stamped results via the wireless network. The MSB-units are primarily battery powered. Alternative energy sources in the sense of “energy harvesting” (photovoltaic cells, energy from movements or pressure variation) are investigated to make the modules maintenance-free as much and as long as ever possible. A synchronisation with the system clock is periodically carried out to ensure accurate time-stamps.

Falls constitute one of the major safety and health risks in older people. For this reason the detection of possible falls plays an essential role in the concept of the sensor technology to be used. Feasibility tests with state-of-the-art accelerometers have shown that already a small number of accelerometers placed on the floor have the potential to detect the impact of a body to the floor and to relay this event whenever the signal shows certain characteristics in the combination of signal amplitude, duration and frequencies.

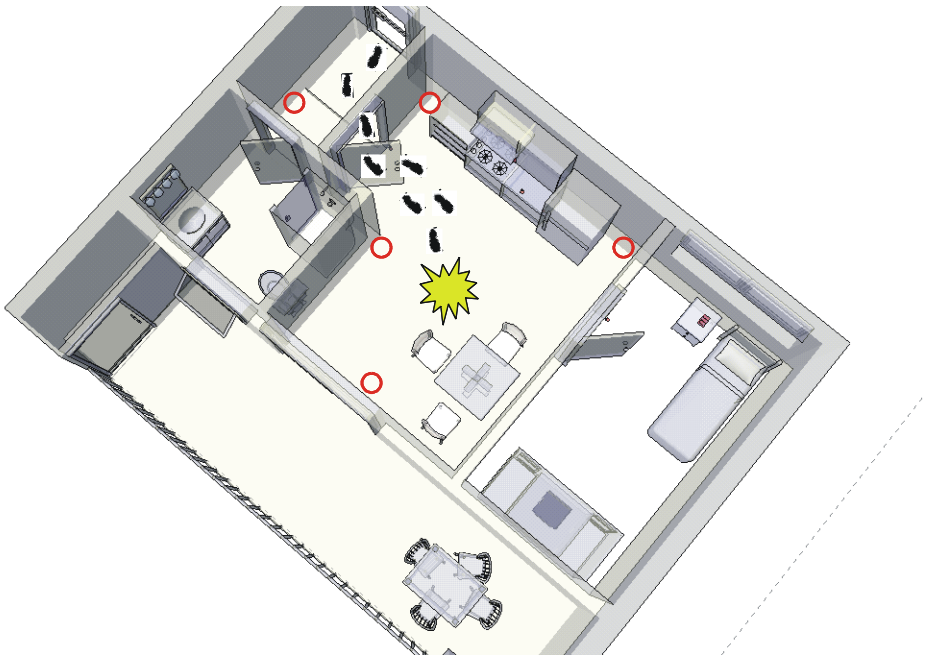

Figure 4: Floor-plan of a home equipped with several accelerometers for

An optional second type of sensor application regards the technology for an instrumented power outlet - IPO (wall mounted or as a power-strip) which has the capability to measure voltage and current (power) fed into an appliance connected to this power outlet. Wireless technology is also used here in order to report the readings to the e HCU.

The system provides two different user interfaces:

- The Local User Interface (LUI): This is a rather simple control box with a display, a speaker and a suitable input device (soft keys or touch screen). It is linked to the e-HCU by the same wireless network as used for the sensors / actuators – so it can be placed everywhere in the home. The entire software to run the LUI is installed in and executed by the e-HCU.
- The Remote User Interface (RUI): This interface is mainly used by relatives, carers and service providers. It is Web-based and can be accessed by using any Web-Browser. Especial attention is paid to administer the access rights in a proper way and to guarantee a high level of data protection (encryption, various levels of access rights).
- Optional a central Alarm Routing Server (ARS) can be used, which provides a VoiP-telephony based alarm signalling to central help desks of different alarm or caretaking services.

The ILC will remain as is during the integration with the rest of the **LLM** service components, as each of its functionalities need to be retained, while providing a stable basis for the cognitive training component.

B1.4.2 Cognitive Training Component (CTC)

The CTC is designed to support the cognitive exercising procedure provided by the BrainFitness software. Though any other software could be used for this process, the 6 kinds of cognitive training provided by this package, together with the extensive experience of partners UKON and ATHENA RC on it and the subsequent potential ease of customization and localization have rendered BrainFitness as the optimal choice for the initial deployment and the pilot testing of the

LLM system. This software is already developed and functional, running on systems with minimum requirements:

- At least 256MB RAM (512MB for Windows Vista)
- 1GHz or faster processor
- X24 CD-ROM or DVD drive
- 500MB free disk space
- Headphone jack
- Internet access

Since BrainFitness needs to be executed on a regular personal computer, whose usage we want to avoid in an effort to make the cognitive training procedure more user-friendly and accessible to the elders with reduced familiarity with technology, this component needs to be extended. The envisioned final form of this component will constitute of:

- Software: BrainFitness
- Presentation Layer: Local User Interface of eHome (touch screen)
- Central Management System (CMS): Regular low-cost personal computer close to the minimal running requirements of BrainFitness
- Delivery: Wiring with the rest of the system

The exact way plan this component integration to the rest of the system will be analysed in chapter B1.4.4

B1.4.3 Physical Training Component (PTC)

The system is completed by the Physical Training Component (PTC) which is comprised by custom training equipment. The only prerequisite for this equipment is to be able to provide exercise performance output. This signal will be hardwired to the rest of the system and its results will be processed by the CMS of the CTC.

B1.4.4 Integration of the three components

The service adaptation is divided into two directions: the first one regarding integration of the three aforementioned components comprises and the second dealing with the localization of the service for the countries where it will be piloted. Preliminary work on the merging process indicates that the components can be integrated within required time limitations. The following analysis is provided as evidence to support this claim.

The three components interact in a very clear manner as shown in the picture below:

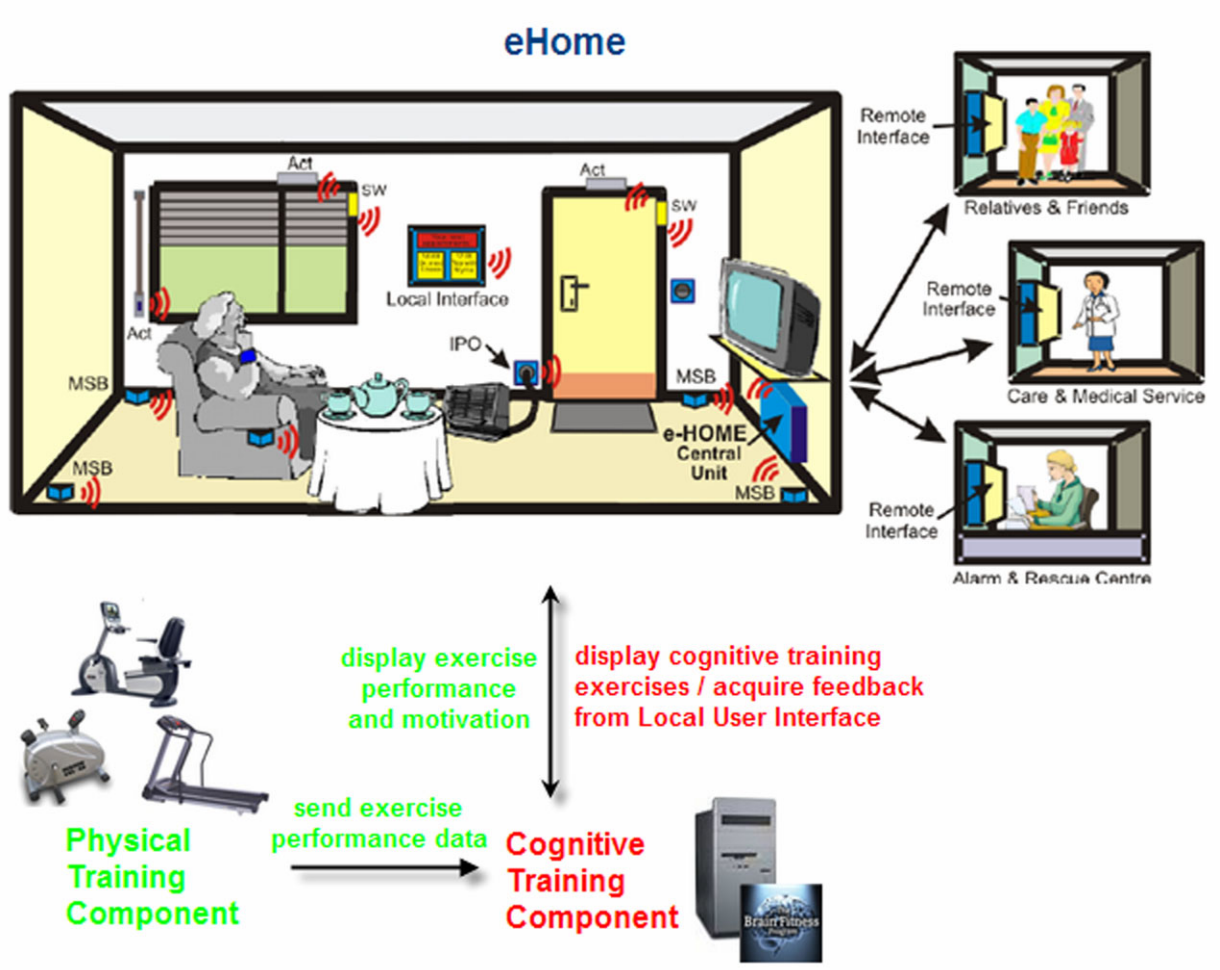

Figure 5: LLM service integration requirements

One of the most profound trivialities of the design is that the physical training equipment is merely used as an input device to the system, by providing signals corresponding to the performance of the user on that exercising device. This information is transmitted to the Central Management System (CMS) of the CTC, which digitalizes the signal and processes its values in three ways:

- By storing it into its local database for future use
- By correlating it to existing values from the database to reach conclusions about the performance and effectiveness of the exercise, creating responses like “Very good”, “Not so intense”, “Try a little harder”.
- By forwarding the digitalized input as well as all processing resulting information to the eHome environment for display

Algorithms needed for the 2nd step of this procedure will simply look up into predefined tables for each training equipment and elderly condition (sex, age, disability etc) and provide the appropriate response. These tables will be defined by a group of medical experts taking part in our consortium during task T.3.1. A relevant table will also be used by CMS to provide the personal training programme for **LLM** users. The parameters for the system’s users will be set on installation. For “At Home” **LLM** installations a few user profiles (and corresponding training programme parameters) will be set on installation. The profiles will change from the LUI. However, for “Day care centre” and “Formal Care Facilities”, multiple user accounts and personal training programmes will be used, that will be administered by the trained staff, having direct

control on the CMS system.

Meanwhile, eHome participates in the physical training process by monitoring the moves of the users and identifying potential problems, as it normally would for any other kind of daily activities. In the case of a problem the eHome environment will act according to its standard specifications and notify for help. Therefore, no technical adjustments should be enforced on eHome in this respect.

The cognitive training procedure is more complicated in the sense that the eHome environment and the CTC (i.e. the CMS) interact both ways: the CTC displays its software through the eHome Local User Interface (LUI) and the eHome transmits to CTC the response of the users – whether this means pressing a button on a remote control or pressing images on a touch screen. The high level description of this process is:

1. The CTC notifies the users for the initiation of the cognitive training procedure according to the training program by displaying a related message on the LUI of eHome
2. The user initiates the process
3. The CTC presents its training content through the LUI of eHome
4. User responds through the LUI
5. The CTC processes the response, stores its value (correct, false) into the database and interacts with the user
6. Steps 3-5 are repeated until the training is concluded or user decides to stop the procedure

To accommodate this procedure, a two way communications scheme should be followed to link CTC with eHome. More specifically, the operational requirements are:

- the CMS should display its exercises on the LUI of eHome
- feedback should be acquired by CMS from the LUI of eHome
- Home Control Unit of eHome (HCU) and CMS displays should appear interchangeably on the LUI

This results into the following technical requirements:

- signals from CMS should by-pass the signals from HCU to the LUI. In other words, once the cognitive training process starts, the LUI would display the CMS output (the cognitive training programme of the BrainFitness software) and not its normal display.
- The system should ensure that only the display of CMS or HCU appear on the LUI

The technical solution for these requirements would comprise of:

- developing a driver for the LUI unit on the CMS
- a switch that would have a controller deciding which display will be shown on the LUI

In conclusion, apart from the necessary wiring to physically connect the three components, the technical adaptations required are well focused, and thus realizable within the available time frame.

Figure 6, shows the integration scheme of the system: LUI of the ILC (a touchscreen Notebook) is used to host in addition to its ILC functionality the CTC- and the CMS-functions. Wired/wireless connections are provided to the ILC's embedded PC which controls the wireless sensor-/actor-network and to the physical training components.

The RUI, which is a system offering a standard Web-Interface like a PC or Notebook is connected form the "outside world" through an standardized TCP/IP connection (Internet, GPRS, UMTS)
An optional central Alarm Routing Server can convert alarm signalling of the LLM system to normal VoIP telephone calls.

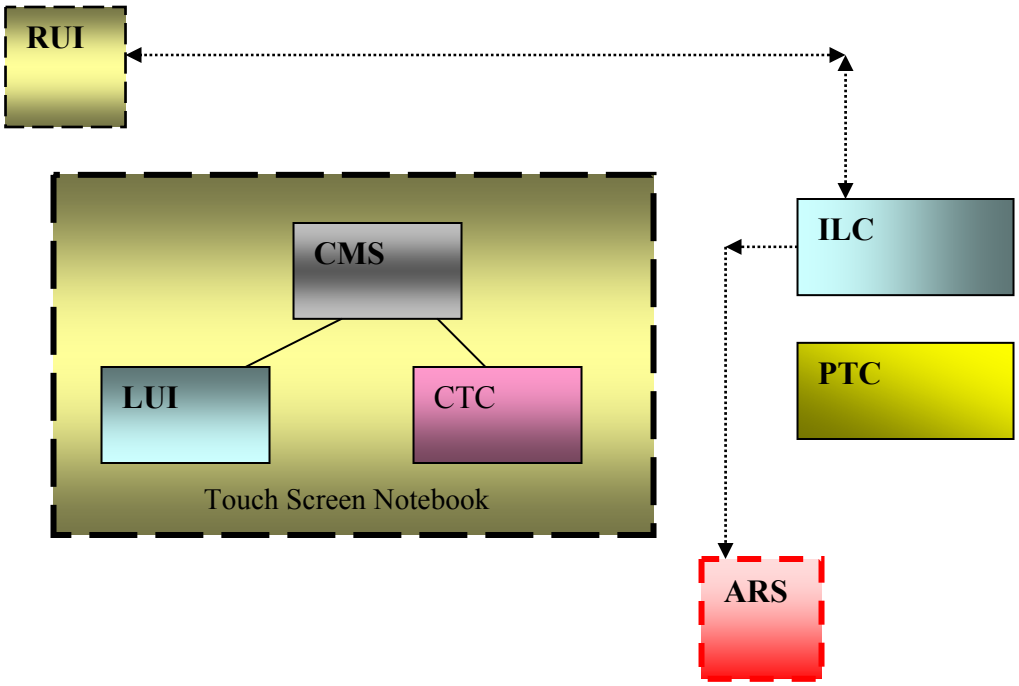

Figure 6: Integration scheme of the system

A more detailed integration scenario is envisaged to take place by exploiting the power of web services and XML; a starting idea is provided in the figure below:

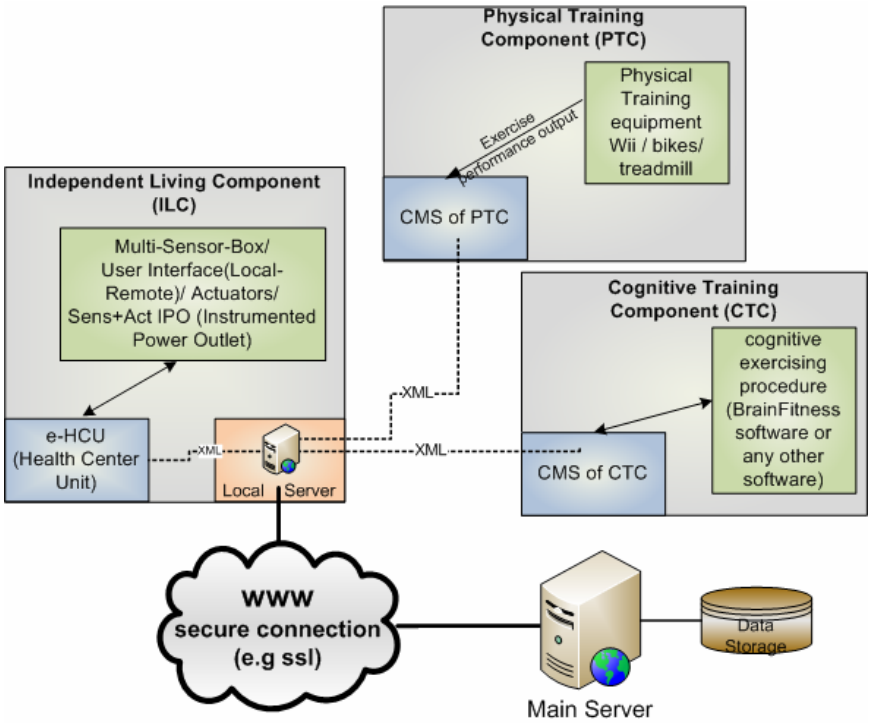

Figure 7: A detailed system integration scheme by use of XML

B3. IMPLEMENTATION

B3.1 Overall strategy and general description

The objective of the proposed project is the integration of several existing separated services into an innovative ICT system for ageing well, called **LLM**, and the subsequent market validation of the resulting system in member states of the EU. To achieve this, a consortium of academic, technical and business expertise will collaborate in order to deliver a high quality service, accordant to legal and ethical standards that will be successfully deployed and piloted in five countries. A number of piloting phases with intermediate feedback, evaluation and adjustment stages will be planned, in order to conclude into a final assessment report. The results of these trials and the conclusions of this report should not only provide valuable insight and improvements for the service itself but moreover indicate strategies and policies for a wide-scale uptake of the **LLM** service, initially all over Europe and beyond its borders in the long term.

Meanwhile, the project's objectives and its results afterwards will be disseminated towards all directions as an effort to raise awareness at the **LLM** service and seek strategic business alliances. National and regional public authorities will be approached throughout the course of the project in order to support the service and promote it into public health institutions or care centres. Moreover, the consortium will closely follow the market trends in the field and identify potential partnerships with regional industry players and investors. Finally, the service will be based in open architecture standards that should incite the interest of SMEs, technology providers and physical training equipment manufacturers, thus creating a market around the service itself.

In conclusion, detailed planning, design and implementation of the service and the pilots in combination with extensive dissemination and awareness raising activities before and in parallel with the pilots comprise the overall strategy for **LLM**. In order to successfully implement this strategy we have divided our work in six WPs. These work packages cover the entire scope or our planned strategy, from Managerial tasks (WP1, WP4 and WP5) to Dissemination tasks (WP2) and Technical tasks (WP3). Besides those, a separate work package has been dedicated to the exploration of legal and ethical issues that should be taken into account during the pilots' design and implementation and that would influence technical and business exploitation choices for the **LLM** service.

To monitor and assess the project's progress and consistency with the aforementioned work plan the consortium has identified a list of major milestones, described below. Additionally, a more detailed description of each work package and of its tasks is given below, demonstrating **what** we are going to do and **why** (in contrast with the descriptions of the next chapter B3.1b, which present **who** is going to do what and **how**):

WP1: Project Management
This WP guides the **LLM** consortium for the successful implementation of the project. This work package includes the coordination and quality control of the undertaken work.

WP2: Dissemination
Dissemination activities are essential for the successful infiltration of an innovative service into the market. A detailed plan presenting and explaining methods and approaches will be elaborated and handed as the first deliverable of the project.

Deliverables: D2.1: Dissemination plan

T2.1: Network of Interest
Creating a network of interested parties in the field (i.e. day care centres, clinical centres for people with mental disabilities, insurance companies, public authorities or elderly people or their

relatives etc) around the project so as to focus our dissemination activities to those on which they might have maximum effect will be an absolute priority.

Deliverables: D2.6: Qualitative analysis of the mailing list/network of interest with involvement of relevant local health and social care public authorities

T2.2: Preparation and maintenance of a web site and
T2.3: Preparation of online and offline dissemination and marketing material

Meanwhile, our efforts will be continuous throughout the project and will be implemented at a local and at an international level, aiming at respective audiences. Therefore, while preparing and forwarding sets of promotional and marketing material to the regions where the pilots will be held, a website will be set-up for wider information about the progress of the **LLM** project throughout its course. Offline material will be produced, including a project leaflet / fact sheet that shall be dispersed before the first pilot to raise awareness about the forthcoming events and towards the end of the project, in order to publish the results of the pilots and draw attention from public authorities and investors.

Deliverables: D2.2 Web site D2.3 Project leaflet / fact sheet D2.4 Report on offline marketing material dissemination

T2.4: Workshop activities
Following the same reasoning, two workshops will be organized: one will be held halfway through the piloting stages and the second one will be held at the end of the project

Deliverables: D2.5: Introductory **LLM** workshop report
D2.7: Final **LLM** workshop report

WP3: Service Adaptation & Customization
The third work package will relate to the merging of the three components constituting the **LLM** service:

1. The eHome AAL environment
2. The Cognitive Training Component (CTC)
3. The Physical Training Component (PTC)

The final result of this work package should deliver the integrated ICT solution, described here as **LLM** service, which will be used in the first phase of the pilots (before underlying any additional adjustments related to user feedbacks, as explained above).

T3.1: Requirements & Configuration

The first task regards setting the operational and technical specifications for the **LLM** service and designing the integration steps for the system. The defined requirements will be used as the basis of the integration process, of the testing of the system and of the operational validation of the piloted systems. The integration plan envisioned for this stage and the technical details to make this happen are more elaborately explained in chapter B1.3.
As for the localization customizations required, they relate to translations of the CTC and the eHome interface menus into the languages of the countries where the pilots will be held. It should be stressed out that the translation of the CTC, which regards the BrainFitness software, is in an already advanced state, since the software was developed in English and has been translated by UKON in German. Therefore the localization tasks to be performed at this stage are (YES = translation required):

	English	French	German	Greek	Spanish
BrainFitness		*YES*		*YES*	*YES*
eHome	*YES*	*YES*		*YES*	*YES*

Deliverables: D3.1: **LLM** technical and operational specifications-Integration design report
D3.3: Cost analysis of LLM system deployment and customization

T3.2: Technical set-up
During the second task of this WP, the technical adjustments defined by the T3.1 and the D3.2 report will be realized on a prototype system in RALTEC labs. Namely, an existing eHome prototype installation will be enhanced with the CTC and PTC following the integration steps and hardware and software requirements dictated by the design task. This will be the first **LLM** prototype that should provide all operational specifications set for the service in the current proposal text and in D3.1.

T3.3: Technical testing and validation
During the last months of this work package, the prototype innovative integrated solution will be submitted to technical testing and validation. Testing will ensure the correct operation of the service in terms of:

- user movement identification by eHome
- emergency detection by eHome
- user interaction with the system
- performance monitoring of the physical training
- cognitive training procedure
- personalized training program development

Validation against these general and all specific criteria set in the D3.1 deliverable will be the objective of this task. The corresponding changes and adaptations to the system should result into **LLM** services system that will used in the first piloting phase.

Deliverables: D3.2: **LLM** system

WP4: Deployment & Operation
Activities belonging into this WP will evolve around the planning, quality assurance and deployment of the piloting phase for the **LLM** service. The Pilot programme will incorporate best practices from the disciplines of technology hardware and software development as well as medical clinical trials, encompassing the testing of the efficacy and marketability of the solution, as well as the collection of user performance data to measure achievement of target cognitive outcomes. The Pilot programme will be designed in a manner to allow for adjustment of technical, training, procedures, and monitoring of outcomes, using an iterative approach. The procedure of the deployment phase is depicted below:

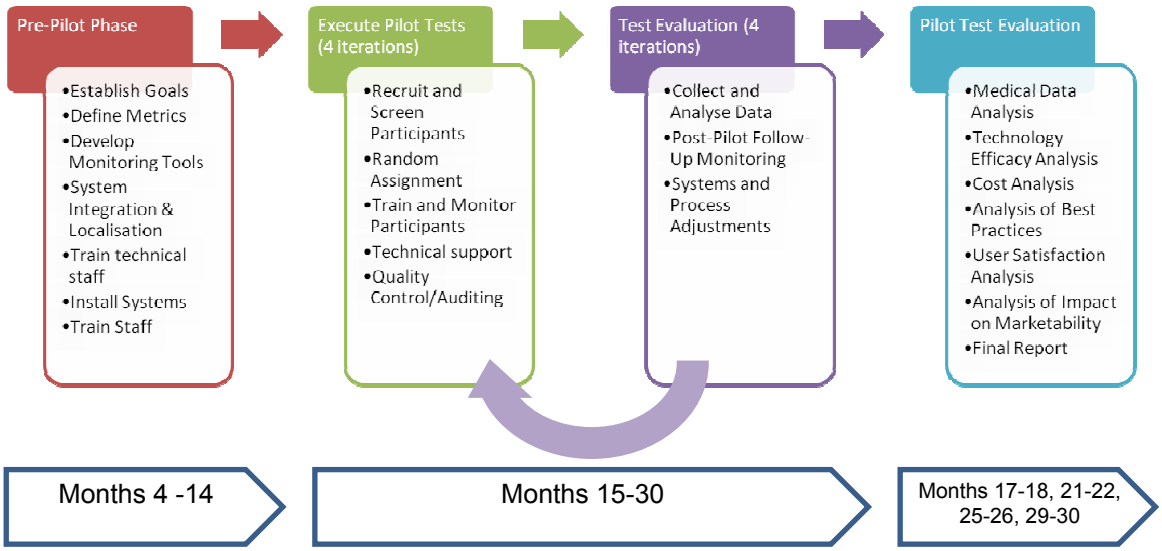

Figure 8: Pilot Methodology

Our deployment plan can be divided into three key phases:

1. Pre-Pilot Phase (tasks T4.1-T4.3): During this phase, efforts will be focused upon preparing all the elements for a successful pilot programme, including:

- Detailed goal setting for technology, processes, and end-user outcomes
- Definition of metrics and suitable approaches to collect the metrics
- Development of any monitoring tools, including questionnaires, standard interview questions, technical log files, medical testing requirements, etc.
- Development of a deployment plan, encompassing all logistical issues.
- Integration and localisation of technical systems will be completed and the finalised system tested in a laboratory environment.
- Development of a quality control/audit programme.
- Installation of systems in pilot site locations. The pilot programme will be executed in elder care facilities, and depending upon the facility, they will participate in one or more iterations of the pilot. The level of participation may depend upon whether more than one institution in the region will be used. The installation will be completed in a room inside the institution specially equipped with the eHome environment (sensors, actuators etc) and user-interface screens. Physical training equipment (recumbent bikes, ergometers) device will exist and will be connected to the eHome environment. An armchair will be set opposite to the interface screen.
- Train staff engaged in the deployment and support of the system, as required.
- Train staff at pilot site locations (technical operations and processes; pilot test monitoring processes).

2. Pilot Test Phase (tasks T4.4-T4.5): The second phase of the project will include 4 iterations of the pilot with different groups of users included in each phase.

3. Pilot Test Evaluation Phase (task T4.6): The last phase includes the post implementation review and evaluation of the pilot procedure according to designated objectives set in the deployment and strategic business plan.

More specifically for each task we have:

T4.1: Deployment planning
An analytical pilot deployment plan will be developed along the lines of inflicting the maximum impact to interested parties, while providing a high quality service whose effectiveness will be evaluated on a number of scientific criteria. Partner IDI EIKON, which has offered remarkable results in the past for eTen and ICT PSP CIP projects, will ensure the former target (organizational quality for maximum impact) and scientific partners UKON and ATHENA RC the latter (training effectiveness). Finally, this cooperation will be complemented by the results of WP6 through the participation of GSI in the task. In addition, the deployment planning process will evaluate the potential impacts on end-users subsequent to the end of the pilot, and determine what mitigating actions may be required to ensure that there are no negative consequences of withdrawal of services from the end-users, including either continuation of services or alternatives/substitutes for the services.

Deliverables: D4.1: Pilot deployment plan

T4.2: Quality of service assurance
Prior to deployment of pilots, a quality assurance plan will be developed, monitoring adherence to defined policies, procedures, training standards, reporting and record-keeping, and other elements of the pilot deployment plan. Throughout the term of the pilot phase, this plan will be executed to monitor ongoing pilot activities and ensure consistency across all pilot sites.

Deliverables: D4.2: Training and Quality of Service Assurance Report

T4.3: Technical support and training
Preparations of the pilot sites will include the technical support from our consortium and the staff training required to accommodate the procedure. In this respect, installations of the integrated pilot **LLM** service will be undertaken by our technical team, while guidance is going to be provided to the medical and supporting staff in each pilot organization with seminars and training documents dissemination.

Deliverables: D4.3: Pilot site installation report

T4.4: Piloting phase
In order to effectively coordinate the pilot deployment across five countries, ensuring consistency in the conduct of the pilots in varying environments and in the collection of data (medical, technological, and procedural), a central coordination and communication process will be established. This process will be defined concurrently with Pilot Deployment Planning in T4.1, and will include communication and reporting mechanisms for normal and exceptional situations (e.g., weekly pilot progress reporting, communication flows for technical questions and results, medical questions and results, etc.). GSI will take the lead role in both the development (and adjustment as necessary) of these processes, as well as for the collection of pilot progress data and reporting to the consortium as a whole.

Pilots will be held in 4 iterations of 3 months with one month in between for adaptation and will be held in five EU Member countries. The partners involved in the coordination of the pilots for each country are:

- Austria: **RALTEC**
- France: **E-Seniors**
- Greece: **IGNA**
- Spain: **INTRAS**
- UK: **GSI and MKC**

The pilots will be held over a period of 15 months, as shown in the timeline below:

Project month	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Pre-pilot			**Iteration 1**				**Iteration 2**				**Iteration 3**				**Iteration 4**			
Austria																			
France																			
Greece																			
Spain																			
UK																			

Figure 9: LLM pilots timeplan

Each implicated partner will be responsible for:

- Recruiting and randomising participants according to criteria set in the deployment plan (according to factors like age, medical history, suffering from mild dementia or other cognitive disability etc) over 3 weeks per iteration (weeks 1-3)
- Training the participants on the usage of the system over one week (week 4)
- Running the **LLM** service, according to the quality assurance reports (results of T4.2) and the training procedure preceding the pilots (T4.3) (weeks 5-8)
- monitoring the procedure for the entire 8 week period
- noticing problems especially in ease-of-use, general usability, motivation effectiveness and general interest shown to the service by the elderly – for medium and wide scale deployments
- technically supporting the users of "At Home" installations throughout the pilots' duration
- holding interviews and handing out questionnaires to acquire the direct opinion of the system's users
- complying with internal pilot reporting requirements as defined in T4.4

T4.5: Pilot evaluation and service adaptation

Each iteration will conclude with a two-month period of trial evaluation and service adaptation. The trial evaluation will be based on the predefined deployment plan targets and expected goals for each region and pilot type as documented by task T4.1. Since, as explained above, these targets include operational as well as training effectiveness criteria, the same consortium subgroup composition of **AUTH, RALTEC, UKON** and **ATHENA RC,** will participate in this stage.

Deliverables: D4.4: Intermediate service evaluation and adaptation reports

T4.6: Post-implementation review

Upon conclusion of the final iteration of the trial, the **LLM** solution will be fully evaluated across a range of criteria, with an expectation of the following key outcomes:

- Efficacy of the technology solution
- Effective supporting processes
- Achievement of desired cognitive and real-world outcomes for the end-user
- Ability of the **LLM** solution to be competitive in the market as a solution for reducing cognitive decline in the elderly

Deliverables: D4.5: Post implementation review / Final evaluation report

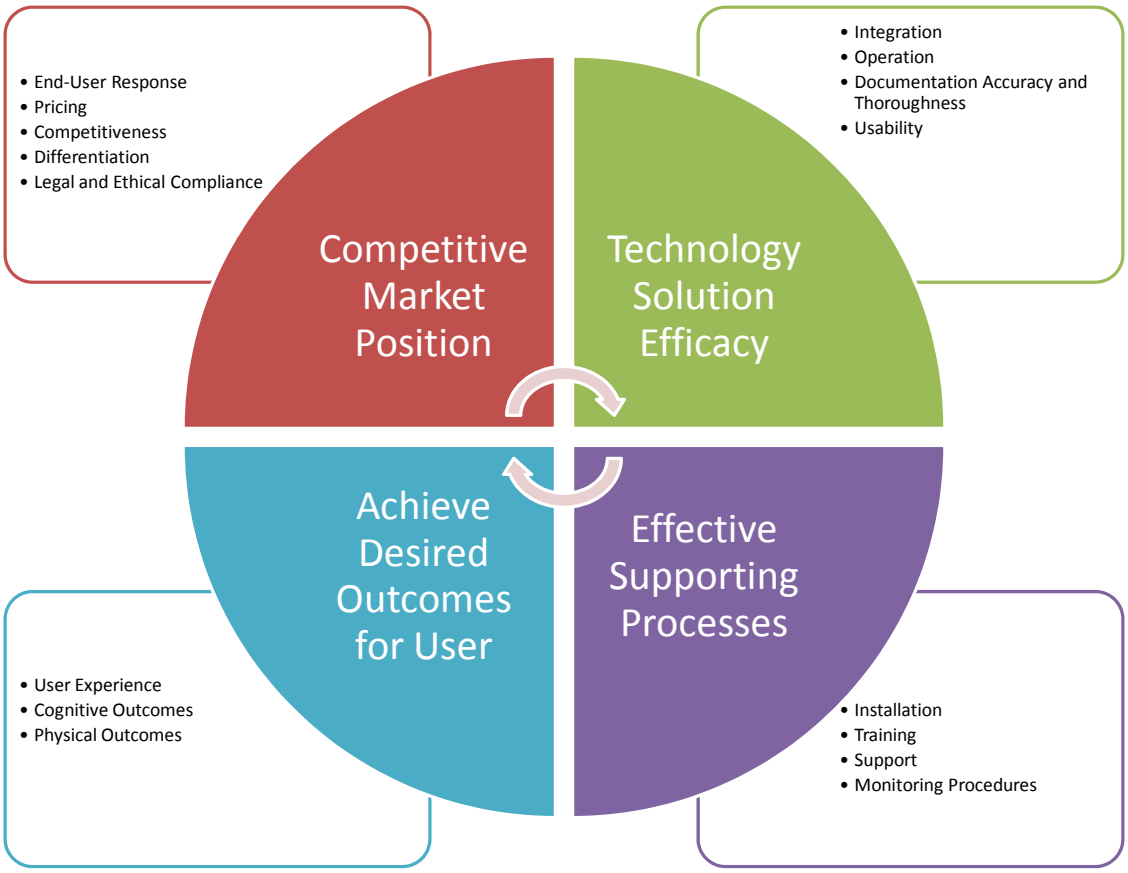

Figure 10: LLM service and project evaluation criteria

WP5: Planning for sustainability

Creating a successful sustainability plan that will be set in effect after the end of the proposal and that will render the **LLM** service viable and widely deployable is of the utmost importance to the project. In this respect, the fifth work package will investigate current market trends with an objective of developing a viable business plan for the service and seeking public and private cooperation. More specifically for each task:

T5.1: Service Market Assessment
The first task includes the performance of a market investigation in the fields of ICT solutions for the elderly. Though several such solutions have been introduced over the last years, these systems are still lacking the wide market penetration they could achieve. Reasons like lack of familiarity with technology from the interested end-users, cost and robustness of features are mainly to be attributed for this issue. Identifying all implicated factors and focusing on countermeasures to promote the **LLM** service in this newly arising market, will be the main target of this task that will be documented on the corresponding deliverable.

***Deliverable*:** D5.1: Service Market Assessment report

T5.2: Business Strategy & Development
The sustainability of the **LLM** service will be based on the Business Strategy developed during this task. The business plan will be based on PPP and on the ways this approach will be promoted and reinforced by the results of the market validation of **LLM** during the pilots. PPP will

present a number of recognized advantages for the public sector to exploit like the ability to raise additional finance in an environment of budgetary restrictions, make the best use of private sector operational efficiencies to reduce cost and increase quality to the public. The strong coupling of Public and Private Partnership suggests working with a very flat hierarchy, to guarantee a rapid flow of information among business (investors, prescriptors, etc) and technical experts. Work on this task will result to the Business Plan for the **LLM** service, including the definition of the New **LLM** Company who will own the IPR of the system and will be responsible for its maintenance and provision to the public.

***Deliverable*:** D5.3: **LLM** Business Plan

T5.3: Public initiatives for financing
T5.4: Private initiatives for financing
Actions will be especially taken at regional level, where it is more viable to create partnerships with public authorities, private companies, local banks, technical providers and foundations. In our understanding, this level of actions is a key factor for the rollout of LLM. This is why the Consortium believes that one of the main possibilities for policy to really help the deployment of LLM is by facilitating the building of real public-private partnerships. To this end we have incorporated three related tasks in this work package, which bear the objective of promoting actions towards this direction approaching companies like: Insurance companies, Health centres and Day care centres belonging to public and private institutions.

Deliverable: D5.2: identification of national stakeholders in terms of local health and social care public authorities related financial models

T5.5: Commercial alliances
The reasoning of the aforementioned tasks is to accomplish by the end of the project's duration strategic commercial alliances based on a public-private financing model that will support the sustainability and the maintenance of the service, while introducing to the market a high quality service, coherent with EU policies on e-Inclusion and social care, in an affordable price and demonstrated ease-of-use. The final service deployment report is going to record the results of our actions and providing modifications or highlighting points of particular significance from the initial business plan that need to be addressed for the successful service viability.

***Deliverable*:** D5.4: Deployment Report (feasibility)

T5.6: IPR strategy and management
This task will provide an IPR framework for the services provided and for orienting the external collaborations. Activities will include:
- clustering with relevant EC services (like the IPR Help-Desk and other ongoing projects (M1)
- a clear statement of IPR strategy (M1 and M12)
- periodic internal review of IPR issues, every twelve month
- generation of a final IPR Management Report (M30)

***Deliverable*:** D5.5: IPR strategy report

WP6: Legal & Ethical issues

Led by **GSI,** which has worked on ethical issues of ambient assisted living (AAL) solutions in several past projects, the consortium will undertake this work package to investigate the ethical and legal status quo and reach to conclusions and decisions on the approaches to be followed during the technical integration of the system to adhere to these rules while offering improved care through the use of ICT. The service should adhere to related rules and guidelines, while the clinical trials should be in accordance with current legislation (especially in terms of privacy

protection laws). In this respect, full anonymity is going to be used throughout the course of the pilots as well as:

- From a technological perspective, the design of the e-Home system, which collects and monitors behavioural data about the elderly participant, retains raw data locally in the HCU (Home Control Unit), and transmits an alarm/signal to an external third party for attention under exception conditions only, without providing any detailed personal or location data. Moreover, the CMS retains performance data strictly locally as a

- From the perspective of informed consent, special care will be taken with respect to providing full disclosure about the pilot programme, its technological and privacy implications, to the end-users. Best practices will be employed in ensuring that participants have been fully informed of these implications, and are able to provide consent, with the end-user's consent (as compared to that of relatives, physicians, etc.) taking primacy. These best practices will include the development of informed consent and release documents for signature by the end-user, in line with each country's relevant laws and regulations, and will accommodate the need to take special precautions for informed consent with end-users who may suffer from mild cognitive decline, and whose ability to provide consent may be in question. Such precautions would follow the approach used in medical clinical trials where the end-user's caregiver network and particularly, their primary caregiver, may be consulted in the informed consent process.

T6.1: Ethical issues guidelines

This task includes delivering a report on the guidelines that should be followed throughout the project in order to protect the basic human rights like privacy and dignity of all implicated end-users. Considerations that should be regarded during the specifying technical aspects of the integrated service are going to be explicitly spelled out and validated external independent factors. In this respect, guarantees on the full anonymity of the test and real users of **LLM** as well as protection of the information data are to be flow addressed.

Deliverables: D6.4: Ethical guidelines report

T6.2: Legal issues

The second task involved in our work entails the study of existing national and European legislation regarding clinical care experiments, marketing rules and privacy management. The objective of this task is:

- to safeguard the adherence to legal stature of each country where pilots will be held
- to ensure that our business exploitation and wide deployment plans are in accordance and will not be in anyway hindered by current legislation
- to identify possible risks sourcing from privacy protection laws and take them into consideration during the specification of the technical and operational requirements.

Deliverables: D6.1: National and European legislation on the clinical care trials and eCare systems

T6.3: Security, data protection and privacy management

The elaboration on the technical prerequisites that should be adhered to by the prototype integrated **LLM** service comprises the fundamental objective of this task. For example, this task should include the definition of whether any data will be encrypted, of the information flow, of the anonymity assurance mechanisms etc, and generally of ways that would render our final technical solution coherent with legal and ethical requirements.

Deliverables: D6.2: Technical specifications for user privacy reassurance
D6.3 National and European security and certification requirements including issues of liability

Work package number :	**3**		Start date or starting event:		M1	
Work package title:	Service Adaptation & Customization					
Participant number:	*1*	*2*	*3*	*4*	*5*	*6*
Participant short name	AUTH	UKON	ATHENA RC	Tero	**RALTEC**	EIKON
Person-months per participant:	14	5	2	0	**24**	0
Participant number:	*7*	*8*	*9*	*10*	*11*	
Participant short name	INTRAS	e-Seniors	GSI	IGNA	MKC	
Person-months per participant:	0	0	5	0	3	

Objectives

The objectives of this work package are to integrate two existing ICT solutions with physical training equipment, thus delivering innovative ageing well / independent-living support services for elders. As the **LLM** service can be categorized under the merging of existing ICT solutions approach, the third work package regarding service adaptation and customization comprises of:

- Providing the final service operational and technical specifications
- Integrating the three components of **LLM** (Intelligent Living Component – ILC, Cognitive Training Component – CTC and Physical Training Component – PTC)
- Testing, validating and adapting the service to adhere to the afore-mentioned specifications
- Localizing the service according to the regions where pilots will be held
- Delivering the **LLM** system that will be used for pilots

Description of work

As has thoroughly been explained in chapter B1.3, the integration of the currently existing prototype solutions towards the construction of the **LLM** service will be based on the trivial interconnection of the CTC and PTC to the eHome solution of the Intelligent Living Component. In this respect, the most suitable partner to lead this work package is RALTEC, which has developed the eHome solution after a two-year research on relevant AAL solutions and approaches. **RALTEC** will cooperate with partner **AUTH**, will significantly contribute towards the delivery of the integrated system. The workload involved to make this happen consists of the following tasks:

T3.1: Requirements & Configuration

This task involves the definition of all operational and technical requirements of the **LLM** service. Operational requirements are strongly correlated with the cognitive and physical training process and the personal training programme scheduling. Therefore, **UKON** and **ATHENA RC** partners which possess expert knowledge in the field will provide their insights towards improving the effectiveness of the training programme for the delivered service. The operational specifications and the technical requirements will also affect the integration process design, which will be precisely documented and delivered to the PO. Meanwhile, the envisioned solution should properly address interoperability and standardization issues: we already know that the proposed architecture is not limited either by a specific CTC or PTC. In this respect, alterations, extensions and even replacements may lead to improved service features, especially in the case where trial results contradict previous assignments and work hypotheses.

Moreover, this task will include the definition of the required steps towards the localization of the service. Partner UKON which has already translated the BrainFitness software in German, will facilitate the process by indicating the vocabulary that had to be translated and the programme configuration that needed to take place. Meanwhile, RALTEC will provide details on how this procedure should take place regarding the ILT component to the **LLM** solution.

T3.2: Technical set-up

In the framework of the second task, **RALTEC** and **AUTH** will follow the methodology defined by the **LLM** integration design report to provide all missing parts that need to be developed, like the driver

for the Local User Interface (LUI) for the Central Management System of CTC or the required inter-component communication infrastructure. We anticipate both steps to complete on-time:

- First because RALTEC has already developed drivers for the LUI
- Secondly because the inter-communication infrastructure merely requires hard-wiring the PTC to the CMS, digitalizing its output (if it is not already in such a form) and processing it by the CMS

Moreover, the localization procedure can be widely based upon the paradigm of the BrainFitness software translation for the German language. In this respect, we regard that the six-month period and the relatively low amount of effort dedicated to the integration process should more than suffice to deliver the first prototype of the integrated system.

T3.3: Technical testing and validation

During the last months of this work package, the prototype innovative integrated solution will be submitted to technical testing and validation that should take place in **RALTEC**'s labs. Testing will ensure the correct operation of the service in terms of:

- user movement identification by eHome
- emergency detection by eHome
- user interaction with the system
- performance monitoring of the physical training
- cognitive training procedure
- personalized training program development

Validation against these general and all specific criteria set in the D3.1 deliverable will be the objective of this task. The corresponding changes and adaptations to the system should result into **LLM** services system that will used in the first piloting phase.

Deliverables

D3.1: **LLM** technical and operational specification - Integration design report (Month 6)
D3.2: **LLM** system (Month 10)
D3.3: Cost analysis of **LLM** system deployment and customization (Month 14)

Milestones

M2: Selection and purchase of training and other equipment for Austria pilot (Month 6)
M3: Equipment installed; initial test and testing of equipment for Austria pilot (Month 8)
M5: Selection and purchase of training and other equipment for the other trials (Month 9)
M6: Technical integration of the Austrian site –Initial Service Adaptation and Customization for all trials (M 10)
M8: Equipment installed; initial test and testing of equipment for the other trials (Month 12)
M11: Technical integration of all sites – Service Adaptation and Customization completion (Month 14)

Work package number :	**4**		Start date or starting event:		M4	
Work package title:	Deployment & Operation					
Participant number:	*1*	*2*	*3*	*4*	*5*	*6*
Participant short name	AUTH	UKON	ATHENA RC	Tero	RALTEC	EIKON
Person-months per participant:	39	15	13	2	27	8
Participant number:	*7*	*8*	*9*	*10*	*11*	
Participant short name	INTRAS	e-Seniors	**GSI**	IGNA	MKC	
Person-months per participant:	49	49	**26**	31	43	

Objectives

The objectives of this work package are to demonstrate the significant impact potential of LLM service in five different countries.

The target of the deployment and operation work package involves the successful implementation of the service's demonstration in all piloting sites. As explained earlier **LLM** is scheduled to be delivered in three versions:

- **At Home**: for home environment installations
- **Day Care**: centre medium scale installations
- **Formal Care**: large scale installations

Our pilots are planned to validate all these versions in the various testing sites thus reaching conclusions for the subsequent uptake of the service by whole value chain in the corresponding market (end-users, day-care centres, clinical care centres). Besides that, another objective of the work package is to evaluate the service itself in terms of operational adherence with the specifications set in the previous work package. Finally, the results of the pilots should reach the target goals set for each region as roughly presented in this report (chapter B1.1.5) and thoroughly elaborated in the deployment plan to be evolved in this work package.

Description of work

Partner **GSI** is responsible for planning the methodology for the piloting and operational stage of the service. According to preliminary study of the partner on the field, the work involved in this work package will be divided into three phases:

- **Pre-Pilot Phase**: Preparation for the pilot, specific target and success criteria definitions
- **Pilot Test Phase**: 4-round pilots comprising of 3-month pilot tests and 2-month for evaluation and adaptation procedure (the last month of the former and the first of the latter occur simultaneously). Each iteration may result into small adaptations or extensions to the service to better address user needs and real usage requirements
- **Pilot Test Evaluation Phase:** Following all iterations, the final pilot evaluation will reach the overall conclusions of the process, underlining points of interest that need to be taken into account during the wider deployment of the service after the project's conclusion

T4.1: Deployment planning

An analytical pilot deployment plan will be developed along the lines of inflicting the maximum impact to interested parties, while providing a high quality service whose effectiveness will be evaluated on a number of scientific criteria. Partner **IDI EIKON,** which has offered remarkable results in the past for eTen and ICT PSP CIP projects, will ensure the former target (organizational quality for maximum impact) and scientific partners **UKON** and **ATHENA RC** the latter (training effectiveness). Finally, this cooperation will be complemented by the results of WP6 through the participation of **GSI** in the task. In addition, the deployment planning process will evaluate the potential impacts on end-users subsequent to the end of the pilot, and determine what mitigating actions may be required to ensure that there are no negative consequences of withdrawal of services from the end-users, including either continuation of services or alternatives/substitutes for the services.

T4.2: Quality of service assurance

The same partners will be involved in the definition of a quality of service assurance plan, which will