Project Outline Annex

DEMWatch

Dementia Watch System

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# Project key data

## ACRONYM and full-length title

DEMWatch - Dementia Watch System

## Abstract

World Health Organization data suggest that neurological and psychiatric disorders are an important and growing cause of morbidity. Dementia is a deterioration of intellectual function and other cognitive skills that is of sufficient severity to interfere with social or occupational functioning. There are worldwide 35.6 million patients of dementia by 2010, which by 2030 is thought to increase 65.7 million and to 115.4 million by 2050. This opens up the opportunity to understand the societal costs of dementia, its impacts upon families, health and social care services and to address the challenge by the help of ICT.

DEMWatch is going to address this burden faced by a growing number of people worldwide by offering an indoor and outdoor locating system with context alerts and notifications by the use of embedded systems with ultra-low power design concept, low cost and easy programmable interconnected devices to help monitor the patients, support their treatments and increase their quality of life. A widespread use of the system is foreseen mainly patients themselves, their families, experts, then hospitals, health care centers, dementia communities, etc.

The loss of memory functions is perhaps the most overwhelming issue that people fear about in getting old, and the problems with dementia are similar in many ways to many other memory disorders, such as brain injuries and stroke. These express themselves especially as problems with short term memory, confusion and disorientation, which cause difficulties in coping with daily life activities and reliance on other persons for assistance, leading to dependency and finally life in institutions. Early recognition of memory disorders, rehabilitation and support to carry out daily activities is essential in providing the possibility to carry on independent living as long as possible and hence to decline the costs of institutionalized care. Here, technology can be of great benefit. The brain remains plastic throughout life and with training it can be rewired to learn new skills, but a technical aid can be taken into use before the memory of the user starts to deteriorate severely. The person should learn to use the system and accept it as his or her personal help. When using the system is self-explanatory in the everyday life the person would benefit also from it when the memory starts to deteriorate.

For the reasons mentioned above, DEMWatch is going to address also the problems of people with light and severe memory disorders by creating solutions and developing technology for supporting the everyday life of people with different kinds of memory problems as well as their relatives and care givers. The technology could include indoor and outdoor based applications and applications for memory exercise and rehabilitation.

## Project duration & size

Start date: 01.07.2013 / End date: 31.12.2015

Duration: 30 months – Roughly Estimated Effort: 94.28 PY – Roughly Estimated Budget: 7963kEuro

## Positioning on the ITEA Roadmap

Application Domain: Society / Subdomain: Me

Technology Category: Infrastructures & Basic Services / Subcategory: Services, System and Software Creation

## Relationship with other Projects or ICT Clusters

## Key person information

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# Project one-page description

Memory disorders and dementia result in a progressive deterioration of cognitive and functional abilities and interfere with social and occupational functioning. Even slight memory loss has an immediate impact on the quality of life of the person as well as relatives or other near ones. There is a great need for solutions to assist the care by supporting early diagnosis, prolonging independent living, exercising memory, monitoring for safety, and supporting memory functions. Also, there is a growing demand for memory training applications for active people who are worried about losing their mental edge.

**The goal of the project** is to address the problems of people with slight and moderate memory disorders by creating assistive indoor and outdoor technology for supporting the everyday life. The user may be a person with memory disorders, family carer, and formal caregiver, member of rehabilitation staff or clinician. The outcome is expected to produce new applications that allow for long-term assistive solutions with an unprecedented awareness of the user's needs and intentions, and rehabilitation solutions which are both efficient and fun to use. The project will start defining a number of case studies by analysing the forms of life of people with memory loss, ideating scenarios and use cases for assistive technology in the chosen domains and taking into account value co-creation and business opportunities. It will simultaneously develop assistive technology i) for early detection and training of memory functions based on serious gaming technology, and ii) for locating people and their context. The indoor and outdoor locating system will be using embedded systems with ultra-low power design concept, low cost and easy programmable interconnected devices. The functionality, applicability and acceptability of developed applications will be validated with real users.

**The innovation lies** firstly in the ability of the solutions to take the user's life situation into account, observe and adapt to the behaviour, and apply serious gaming techniques. Secondly, the application can be adapted for early assessment of memory impairments and setting in proper medication and rehabilitation early. Thirdly, the same technology can be used for several purposes by one user and for different purposes by different users or actors involved in the life of persons with memory disorders. Fourthly, the charging of device will be carried out with the help of wireless technologies and energy harvesting. Finally, the development work will be based on a multi-dimensional Life-Based Design methodology which derives design goals by a thorough exploration of people’s forms of life, values and everyday contingencies, understanding of the cognitive processes involved and capturing and modelling of their daily behaviour and, finally, an efficient integration of this data into design as the actual drivers of design processes.

**The major expected outcome** is to produce new applications that allow for long-term assistive solutions with an unprecedented awareness of the user's needs and intentions, and rehabilitation solutions which are both efficient and fun to use and adaptable for the needs of people. Assistive technology has a potential to contribute to the independence and safety of persons as well as to sustain their capacity to be active and live at home longer. DEMWatch’s low cost solutions will create the right **business impact** on time. The advance in ubiquitous computing, including interoperability, pervasive computing power, low-power devices, and a high penetration of sensor-equipped interactive devices allows for capturing the user's behavior more accurately than ever before. With the help of the new technology the quality of life of the users and their caretakers is improved and rehabilitation of memory impaired patients will shorten. Also societies will save billions as people with memory disorders will cope independently longer and the care needs to be less intensive. **The business relevance** of this project should be understood through the importance of early detection and rehabilitation of memory disorders, potential for new kind of customer value creation and the know-how of releasing technology that will be widely accepted by the users.

Overall **system** can be described as the use of sensor agents such as smart devices providing care data to the interested parties, on the top of which will be set a communication layer supported by a decision making system. This part is mainly in conjunction with the ITEA2 roadmap **Infrastructures & Basic Services**.

The project consisting of a lot of software intensive works, is also addressing the **Services, System and Software Creation** domain of the roadmap and both segments of user at the same time: **Me** – (Patient and smart devices achieving a monitoring and reporting goal), **Society** – (Project will bring together dementia societies to provide technological assistance and social interaction)

The application and services domain addressed by this project will be on **Health, Aging Population, Security and Safety** topics which are also defined by new roadmap.

**Project Keywords:** Wireless Sensor Network, Energy harvesting, Elderly Health Care, Indoor and Outdoor Locating, Ultra Low Power Design Concept, Embedded systems, Technology Assisted Memory Assessment, ICT for aging people

# Project Added Value

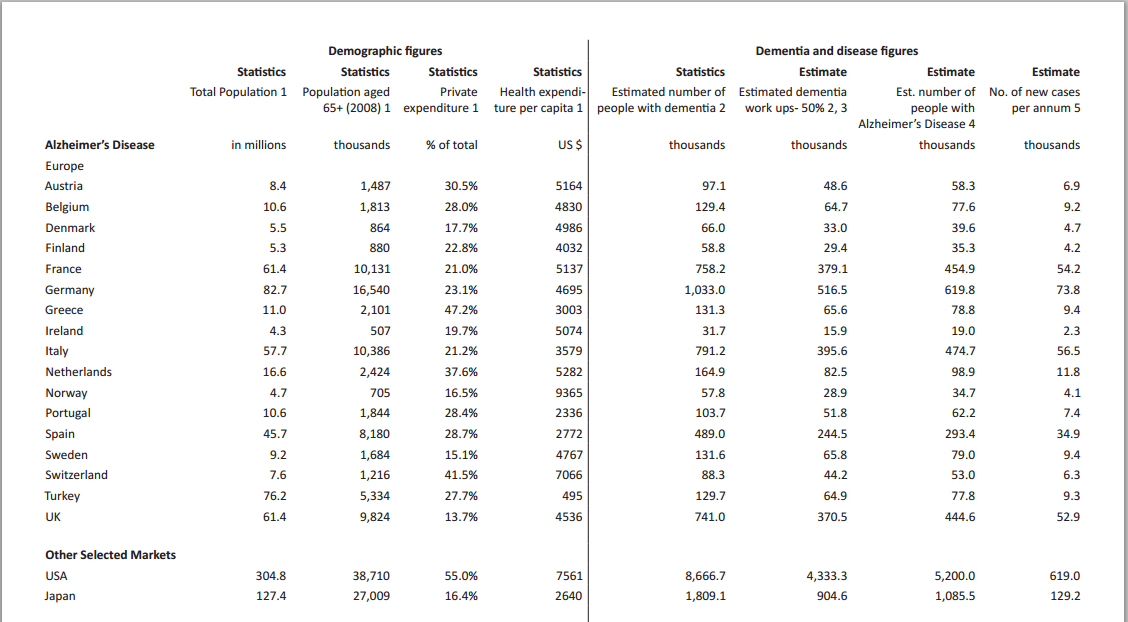
## Rationale of the project

Dementia is a deterioration of intellectual functions and other cognitive skills that is of sufficient severity to interfere with social or occupational functioning. Of the many diseases that lead to dementia, Alzheimer is the most common cause worldwide among people age 65 and older. Difficulty remembering names and recent events is often an early clinical symptom; apathy and depression are also often early symptoms. Later symptoms include impaired judgment, disorientation, confusion, behaviour changes and difficulty speaking, swallowing and walking.

Cognitive and physical regression of patient will ultimately require 24 hour care. Although medical advances can slow early stage decline, dementia develops worse in time and remains a terminal disease. With this difficult outlook, caregiving can become all-consuming as loved one diminishes over a period of years. Challenges faced by dementia patient’s caretaker could be summarized as below:

* Overwhelming emotions as capabilities lessen
* Fatigue and exhaustion as caregiving demands increase, independence disappears
* Financial and work complications as costs rise and resources are challenged

A proper understanding of the **societal** costs of dementia, its impacts upon families, health and social care services and governments will help us address this challenge better. In the table below, dementia facts and figures presented:



(1) Espicom, the World Medical Markets Fact Book 2008

(2) Europe: Alzheimer Europe, Dementia in Europe Yearbook 2006.

(3) Estimated dementia work ups assumed to be 50% of estimated number of people with dementia.

(4) Estimated number of people with Alzheimer’s disease assumed to be 60% of estimated number of people with dementia.

(5) Number of new cases of Alzheimer’s disease per annum estimated as est. no. of dementia work-ups divided by assumed life expectancy which is set to 7 year

(6) Other types of dementias (e.g., dementias caused by circulatory problems) are also an increasing tendency with the aging population.

(7) Finally, this type of new technology can be used also in case of any common type of memory disorders (e.g., closed head injuries or stoke).

“In UK, annual dementia cost is £23 billion, which is twice as much as cancer, three times as much as heart disease and four times much as stroke; unlike the **economical** the true social impact is incalculable. Most of the cost of dementia – £12.4 billion per year – is met by unpaid caretakers.” - Alzheimer’s Research Trust, UK. Annual cost of one dementia patient and expected rise in dementia cases are shown in figures below:

|  |  |
| --- | --- |
|  |  |

Balancing the enormous task of caring for a cognitively impaired adult with other responsibilities requires skill, attention, and diligent planning. This is where DEMWatch project comes in, technology assisted memory assessment and support at the early phase as well as geriatric care monitoring at later stages to improve the patient’s quality of life by easing the burden of caretaker and decreasing the costs of this long and difficult times of caregiving.

Advancement in telecommunication technologies, especially wireless, the widespread adoption of computers, and the developments in medical and sensor, tele-medicine and mobile tele-health have the potential to alleviate some of the challenges in dementia care cost management. Referring to facts and figures presented above, the **value-proposition** for DEMWatch is going to be attractive in European healthcare industry which has been experiencing substantial and increasing cost pressures in the caregiving of dementia. The cost of implementing a telemedicine infrastructure, and the reimbursement of tele-medicine services remain as major obstacles to tele-medicine, both in the U.S. and in Europe (Statura 2006; Hoppszallern 2007). At present, neither the technology costs, nor the consultations over the technology are reimbursed (Nagy 2006).

“Specifically, the **technical challenge** seeks the development of simple, cost-effective, consistent tools that could be easily used to assess memory, mood, thinking and activity level over time to help improve diagnosis and monitoring of people with Alzheimer’s disease. Today, easy to use, reliable, objective and cost-efficient methods to track and monitor Alzheimer’s disease -- which is not a normal part of aging -- remain an unmet need.” - ALZHEIMER'S CHALLENGE 2012

**The goal of the DEMWatch System** is to propose:

* An indoor and outdoor locating system by use of embedded systems with ultra-low power design concept, low cost and easy programmable interconnected devices to help monitor elder people’s location and context
* Assistive technology for people with slight to severe memory disorders and applications for memory exercise and rehabilitation. It is essential to develop cognition- and behavior-based assistive technology for the early detection and support for people with memory disorders and their families. Such technology could aid in coping with the problems typical to slight and severe memory disorders.

Main **innovative aspects** of the proposed DEMWatch system to mention are:

* Charging of device with help of wireless technologies, energy harvesting
* Memory rehabilitation and solutions for novel technologies such as serious gaming
* Add new elements to the patient environment: television at home environment and mobile devices to outside
* Adapting for diagnostics and rehabilitation purposes

The DEMWatch project’s **key selling points** will be an essential improvement of the quality of life of ageing and elder people’s quality of life by providing conscious, healthy and productive aging for people with the help of easily wearable life items which have low power consumption, plus, a capability of being remotely chargeable.

The number of people who will be facing a life challenge such as dementia will increase dramatically. There are worldwide 35.6 million patients of dementia by 2010, which by 2030 is expected to increase to 65.7 million and to 115.4 million by 2050. **Benefit of DEMWatch project** is to bring social awareness and support to this challenge by the help of latest technologies and methodologies. Continuous monitoring of life quality of dementia people and people with slight memory disorders is crucial regarding the expected dramatic increase in the number of patients. DEMWatch’s low cost solutions are going to create the right **business impact** on time. It is essential also to evaluate new technologies in supporting other types of memory disorders, such as closed head injuries, as the predictions for positive outcome are often more visible in them than in the case of Alzheimer’s disease, for example.

The project is offering solution to the high costs of dementia care with low cost smart devices, which are also easy to use and reliable, that is actually answering the technical challenges too. Easing life of dementia caregiver at each stage of the disease will help a better quality of life, which is also priceless and incalculable/ incomparable gain.

## State-of-the-Art and “roadblocks”

### Technology

As the Alzheimer's spreads, healthcare companies are developing wireless technologies to help caregivers look after their loved ones.

**ETAC (Everyday Technologies for Alzheimer Care) Technologies for tracking dementia patients**

Wireless audio-visual networks and pocket personal computer (PC) technology can be used both to monitor people’s activity over time, and to look for behavioural changes that might be indicative of dementia or show progression of disease. These monitoring systems can be combined with simple magnetic switches on appliances and pressure pad switches on furniture to get a picture of the types of activity that people engage in during their daily routines. Such systems offer many advantages to people suffering from the disease and to caregivers. When those affected by AD are living alone, the systems can provide caregivers and family members with the peace of mind that comes from knowing there is a system in place to monitor their loved one.

In an institutional or nursing-home setting, these systems can also provide valuable backup, since they operate 24 hours a day, 7 days a week. In nursing homes, where professional caregivers are often overworked or may be unfamiliar with the medical history of their charges, monitoring systems have the potential to identify anomalous behaviour that might otherwise be missed. Families and facilities will have the option of choosing monitoring technologies that vary along a continuum of intrusiveness. For example, once installed and activated, in-home sensors will monitor movement, room use, and device use. This tends to be intrusive, although the opportunity to turn off the sensors may be available. Data entry devices such as the PocketPC Buddy system will only accumulate and transmit information that a caregiver has entered, thus falling on the nonintrusive end of the continuum. See Section 3.2.2.for a detailed PocketPC product description.

Feasibility studies indicate that monitoring systems are very beneficial. For example, in a small pilot trial conducted on eight adults over 10 days in a nursing home, video camera technology found three episodes of aggressive behaviour that had been missed by staff members, and six attempts to wander outside the building that had gone unnoticed. In the first in-home usability test of the Pocket-Buddy system, one caregiver’s responses identified him as extremely stressed, resulting in the recruitment of additional support.

A substantial amount of information may be gleaned from these systems. Basic individual welfare can be ascertained. Medication status can determine if persons being monitored are taking their prescription medications at the appropriate times and correct dosages. The system can potentially recognize a problem indicative of dementia, e.g., repeatedly opening and closing a refrigerator door, or some other activity that would not be expected of cognitively normal individuals. Disease monitoring could also warn if behaviour is indicative of disease progression. For example, more frequent aggressive symptoms may signal a significant change in health status. This type of monitoring can be fine-tuned to both gradual and dramatic behavioural changes.

These systems can be used to detect household maintenance such as running faucets and showers, to detect blocked or overflowing toilets, and to monitor household appliances. Systems and technologies have the potential to detect behaviours and events that warn of global safety issues and dangerous risks. For example, doors left open, backed-up toilets, or stove burners left operating may all pose a significant risk. Actual reports of falls, wandering, and other behaviours through interactive systems provide similar safety alarms.

**However, potential problems exist with these systems.** One of the major difficulties with this type of technology is mapping, i.e., it can be difficult to pinpoint the precise location of the participant. With video-based systems, this can be overcome by using multiple cameras to build a 3D picture of the living space. With radiofrequency-based systems, which are not very accurate at measuring distances, one can focus on the shape of the trajectory of participants in their environment rather than on their exact location. This allows the identification of frequently occupied locations within the “trajectory shape,” which can then be calibrated to exact locations by comparing reported activity (e.g., watching television, sleeping, or eating in the kitchen) with the position of a participant in the trajectory map at that time.

**Several other technical difficulties with electronic monitoring exist**, including signal interference, technology incompatibility, and data-review limitations. Signal interference from a variety of household electronics and radiofrequency transmitters can be troublesome for monitoring systems. Appliances such as microwaves, household heating and cooling sensors, wireless phones, and wireless computer networks cause problems and can result in false alarms. This problem is likely to become worse as more appliances and applications become wireless. For radiofrequency-based systems, the selection of a frequency band that is interference-free is important. In the case of systems that rely on off-the-shelf software and hardware, updates from manufacturers can often be detrimental because they may introduce incompatibilities or new interference patterns. Dedicated systems such as the pocket PC based PocketBuddy use custom-written software with automatic updating.

A possible future solution, allowing monitoring systems to maintain an individual’s privacy, is to monitor infrared wavelengths only.

Cell phones are relatively simple, light, and wearable devices that can be used to communicate with individuals, mainly as a reminding device. A week’s or a month’s worth of short video messages, recorded with a computer and webcam, can be loaded into the phones and set to deliver appropriate messages at the appropriate time. The system design can also accommodate a certain degree of flexibility, so that messages can be updated or substituted on the go. This may be particularly useful for the busy caregiver who may have to delay visits or alter schedules. These systems are being designed backwards, from the end-user. Appropriate target activities will be identified and developed via interviews with people affected by AD and their caregivers. These will then be tested in the field, and appropriate adjustments will be made. **Problems and areas for future development include**:

* What to prompt? Choosing the best prompt that is most likely to get the desired response is important.
* How to prompt? Prompts can be images, an engineered machine voice, a recorded human voice, or a tone. Voice prompts have the advantage of being able to deliver very specific messages. Recorded human voices may be less irritating and more comforting, especially those of a family member or primary caregiver. However, populating systems with recorded messages may take considerable time.
* How to input prompts? If systems are flexible enough that prompts can be customized, the input interface must be user-friendly.
* How to cope with ignored prompts? The systems should be flexible enough to recognize when users are ignoring prompts, and respond appropriately. Developing this capability may be challenging.
* How to handle data volume? Monitoring systems will contain a high number of variables, and the volume of data generated for analysis will be considerable. Systems must be robust enough to cope.

There are many different technologies that can be adapted to the needs of someone with memory disorders or dementia:

**Memory aids**

* **Reminder messages** − A personal voice prompt recording can remind things that a person may forget
* **Clocks and calendars**− Automatic calendar clocks can be helpful to remind which day it is.
* **Medication aids** − Automatic pill dispensers remind and advice in taking medication.
* **Aids for reminiscence and leisure** − Multimedia software is available to evoke memories and stimulate conversation, by showing photographs or films about how life used to be, and playing music that is familiar to the person.
* **Memory performance diagnostics** - Serious gaming technologies can be used in the diagnostics and monitoring of memory performance of patients.
* **Memory training programs** – Serious gaming can be used to design and implement modern memory training procedures.
* **Taking care of everyday errands** – ICT-technologies can be used to support people with such practical aspects of everyday life as shopping, paying bills, and taking care of nutrition and hygiene.

**Tele-care**

Sensors around the home can be linked via a telephone line to a nominated person or call center to detect a range of situations that could indicate a potential hazard, including:

* **Floods**− sensors can be fitted on skirting boards or floors in the kitchen or bathroom
* **Extreme temperatures** − sensors will send a warning signal if the temperature is very low, very high, or if there is a rapid rise in temperature.
* **Gas**− sensors detect if someone forgets to turn the gas off, and a device will automatically shut off the gas and raise the alarm.
* **Falls**− sensors worn on the hip can detect the impact of a person falling.
* **Absence from a bed or chair**− if a person gets up and doesn't return within a pre-set time system can raise an alarm.
* **Getting up in the night**− bed occupancy sensors or pressure-mat sensors placed by the bed can be used to activate an alarm when the person gets up in the night, to alert someone to help them get to the toilet. Similarly, lights with movement sensors can be fitted to switch on if a person gets out of bed or enters a room.
* **Leaving the home**− the system may be set up to trigger a response if the front door is opened, perhaps during specified times − for example, at night, or if a person does not return within a specified time. Door systems such as these use passive infra-red (PIR) or door contacts, and can help to reduce risk and retain the person's independence.

**Devices to enable safer walking**

Tracking devices use satellite technology to help trace someone who has gone missing. A person's location can be viewed on a computer or mobile phone. Most devices have the facility for the person carrying the device to press a panic button if they get lost. A mobile phone with location finder technology could also be considered instead of a stand-alone tracking device. This kind of technology can also be used as navigation and communication help for people with impaired memory.

Given the state-of-the-art, in this technological domain how DEMWatch relates to or is differentiated from other projects is described in table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Project Name** | **Prog** | **Time period** | **Technical Focus** | **Relation to, and difference with, this project proposal** |
| **NEUROTAS** | FP6 | 2007-2010 | Develop a prototype miniaturized system for diagnostics in the early stage of Alzheimer disease and other neurodegenerative diseases, or as a point-of-care instrument for patient follow-up. | This project is featuring diagnosis. DEMWatch is a solution for the improvement of caretaking. |
| **CogKnow** | FP6 | 2006-2009 | The focus of this project is to assist people with dementia to reinforce their daily life. The technological objective is to research and prototype a successful, near-to-market, portable, remotely-configurable, user-validated cognitive prosthetic device and associated services for people with mild dementia. | This project offers user validated cognitive prosthetic device. DEMWatch offers indoor, outdoor locating and context reporting |
| **PredictAD** | FP7 | 2008-2011 | The objective of PredictAD is to find the best combination of biomarkers for AD diagnostics from heterogeneous data (imaging, electrophysiology, molecular level, clinical tests, demographics) and to develop clinically useful tools integrating the optimal biomarker results | This project is featuring diagnosis. DEMWatch is a solution for the improvement of caretaking. |
| **DEM-CHILD** | FP7 | 2011-2014 | This project focuses on the main cause for childhood dementia. High-technology SMEs will develop innovative cost- and time-effective testing and screening methods for all NCLs. DEM-CHILD will collect the words largest, clinically and genetically best characterized set of NCL patients. Novel biomarkers and modifiers of NCL will be identified. | Totally different context in the same domain. DEMWatch is assisting the care process of dementia itself. |
| **APOPIS** | FP6 | 2004-2006 | The APOPIS project is designed to apply the unique information provided by sequencing of the human genome to further understand and to develop treatments for these devastating diseases. The chosen approach is based on human population genetics complemented by the identification of modifier genes in model organisms that express both wildtype and mutant variants of known disease-related genes. | This is medical and genetically research project unlike DEMWatch which improves caretakers life |
| **DANUBIOBANK** | FP6 | 2006-2008 | A key element in this project is the availability of well classified, large enough patient cohorts and the establishment of quality-controlled central banks for DNA, serum, plasma, and cells/tissues/RNA/proteins together with the development of an IT based infrastructure to provide samples and data required for biomedical studies. The proposed initiative aims to establish a "Danubian Biobank foundation for public utility in molecular medicine of aging disorders" connecting universities, associated teaching hospitals, primary prevention programs, and endpoint-related rehabilitation clinics along the Danube river and in neighboring regions. | This is biomedical project unlike DEMWatch which is ICT for dementia treatment |
| **COMPANIONABLE** | FP7 | 2008-2012 | The main unique selling point of the Companionable project lies in the synergetic combination of the strengths of a mobile robotic companion with the advantages of a stationary smart home, since neither of those approaches alone can accomplish the demanding tasks to be solved. | Smart Home and robotic solutions are used in this project unlike DEMWatch which is about a wearable device that monitors patient and reports location |
| **DEM@CARE** | FP7 | 2011-2015 | The objective of Dem@Care is the development of a complete system providing personal health services to people with dementia, as well as medical professionals and caregivers, by using a multitude of sensors, for context-aware, multi-parametric monitoring of lifestyle, ambient environment, and health parameters. Multi-sensor data analysis, combined with intelligent decision making mechanisms, will allow an accurate representation of the person's current status. | The slight difference of DEMWatch lies in its being a low cost device solution with low power consumption embedded smart devices and the innovative part of the solution is also the difference: energy harvesting. There will be R&D work in DEMWatch in a way to provide energy harvesting for the patient’s device |
| **E-HEALTH MONITOR** | FP7 | 2011-2014 | The eHealth Monitor project provides a platform that generates a Personal eHealth Knowledge Space (PeKS) as an aggregation of all knowledge source. | This project is more ehealth in general unlike DEMWatch is for dementia patients wearing a portable device reporting their location and context |
| **SWEET-HOME** | TecSan 2009 call.(French national research program). | 2009-2012 | Collect and combine multi-sensor information to detect activities and assess behavioral trends to provide user services at different levels. | This is not a health project |
| **NUADU** | ITEA | 2006-2008 | The applications of interest include: Lifestyle monitoring to enable independent living for elderly and handicapped people; Weight management, activity monitoring and healthy eating; Heart failure management and cardio-vascular system monitoring; Managing work related stress; | This is also addressing a general topic more than watch of a dementia patients which requires intensive care |
| **AMUPADH** | A\*STAR SERC Home2015 (Singapore national research program) | 2010-2012 | The project addresses the improvement of QoL (Quality of Life) for the elderly, especially those with dementia, by enabling their home with ambient assistive technologies. | Our project is different in few ways that it offers outdoor locating as well. Plus, there is context reporting and energy chargeability by the help of wireless technologies |
| **NEST-DD** | Life Quality | 2000-2003 | This project has the goal to improve the cost-efficiency of early diagnosis of dementia and differential diagnosis among the various types of dementia. | This project is about early diagnosis of dementia unlike ours which is about dementia care. |
| **GUARANTEE** |  | 2010-2012 | The GUARANTEE project is investigating how to use modern communications and networking technologies to help improve personal safety in the home. The objective is to develop active systems capable both of providing direct advice and support to individuals in unsafe situations within the home, and connecting automatically to external advice and support services in the event of need. | GUARANTEE focus is home safe with groups children and elderly. Dementia or memory disorders are not chosen as an area in the project. |
| **MIDAS** | ITEA2 | 2008-2011 | The main goal is to provide a solution offering remote interaction services supporting the daily life of the disabled and ageing society through communication, training, and monitoring at home and on the go. | The slight difference of DEMWatch lies in its being a low cost device solution with low power consumption embedded smart devices and the innovative part of the solution is also the difference: energy harvesting. There will be R&D work in DEMWatch in a way to provide energy harvesting for the patient’s device |
| **HIGH PROFILE** | ARTEMIS | 2011-2014 | HIGH PROFILE aims to develop multi-scale, adaptive algorithms to merge information about the actual behavior of the brain, originating from MRI, MRS, and EEG. | This is pure embedded systems project based on analyzing brain activities unlike DEMWatch which is a support offer for dementia care period to ease caregivers lives |
| **CARE4ME** | ITEA2 | 2009-2012 | Clinical and technological solutions are required that bring together medical data and knowledge from different sources and domains in order to address the complete healthcare care cycle of a medical condition. | Totally different than DEMWatch in a way that taken challenges are completely different |
| **CHIRON** | ARTEMIS | 2010-2013 | The CHIRON Project intends to combine state-of-the art technologies and innovative solutions into an integrated framework designed for an effective and person-centric health management along the complete care cycle. | This project possesses more generalized approach unlike DEMWatch which is specific dementia care system |
| T&Tnet | AAL | 2012-2014 | To provide personalised context-based multimodal and multinational social journey planning with affective capabilities and an easy to follow adaptive real time guidance making use of artificial reasoning based on an information manager (filtering and combining). This solution will allow them to carry out and solve movement tasks and problems independently. | This project is featuring about orientation and navigation for elderly people. DEMWatch is a solution for the improvement of location of the patient |

### Market

Research and Markets estimated in 2011 that 35.6 million people suffer from dementia worldwide and that by 2050 the number goes up to 115 million. As many as 8% of people older than 65 have some form of dementia, so this problem is more severe where the average age of the population is high. 37% of the European population is estimated to be over 60 years old in 2050. Yearly caring costs of an Alzheimer’s patient in USA are calculated to range from $18 000 to $36 000.

The proportion of population with dementia and other illnesses correlating with high age will increase. This is a serious challenge for the medical and social care system but also creates new needs and markets for cost-effective solutions. Therefore, the potential market is very high for assistive technologies that address the issues of demographic ageing and increasing healthcare costs. ICT systems that support independent living at home are expected to be one of the main solutions for a significant reduction of healthcare costs.

A substantial and an increasing segment for commercial services are older adults who are seeking for different ways to keep them active and alert. Understanding the needs of active seniors will represent a major market opportunity for new ICT on international ‘silver markets’. The large age cohort, ‘the baby-boomers’, will turn their attention to products and services which increase their quality of life. Silver markets open up huge challenges for the development and export of ICT. The critical question is how to adapt the design to these markets.

Frost & Sullivan forecasted in 2010 that the total assisted living technologies market revenue in Europe will grow from $155 million in 2009 to $525 million by 2015. The growing market is likely to present good opportunities for SMEs.



Assisted living technology market in Europe, revenue forecast ($ million).

Many of the assistive technologies studied in this project can also be applied for use with other people, including elders in general and children. ABI Research predicted in 2010 that the market for alternative, other than satellite-based location technologies will be $2.5 Billion by 2015. About 60% of Alzheimer’s patients tend to wander, which can be quite dangerous, and could benefit from locating services.

Assistive technologies can help people with slight to moderate memory disorders and people with dementia live more independently and also make life easier for those who take care of them (carers). Many products are available so we only list product categories that belong to the scope of the project, and give some representative examples:

* **Locating:** Mobile phones can be located and inexpensive services allow carers to get patient’s phone’s position anytime. It is technically possible for authorities to get the position also without any such service, e.g. in case of emergency. Some products use cellular networks only for positioning and are not phones (for instance, EmSeeQ with U-TDOA). Satellite-assisted systems may provide more accuracy (SmartCare and many smart phones). Some products also support indoor positioning (Keruve watch). Object locators help to find objects rather than people.
* **Other wearable devices:** Help buttons worn like neck pendants, bracelets or wrist-watches (e.g. Minuet watch) are usually connected to a local safety phone and can make phone calls to predefined numbers (telecare). These make it easy for patients to call for help – if they remember to wear the device and push the button. More advanced devices contain sensors and can alarm automatically (Philips Lifeline with AutoAlert, Vivago with activity sensors and data connection, MySOS with GPS, Halo fall detector with chest strap and heart rate monitor). VivoMetric LifeShirt monitored breathing, heart rate, sweating, skin temperature and accelerations and recorded or transmitted the data to a remote center but does not seem to be available anymore.
* **Home sensors:** Safety at home can be improved by combining various sensors with alarm systems. Potentially useful sensors include bed and chair occupancy sensors, pressure-sensitive mats on floors or furniture, movement and fall detectors, IR beams that surround a safe area, CO and natural gas detectors, smoke detectors, heat detectors, flood detectors, door opening sensors for exit alerts, and pill boxes or dispensers that alarm if pills are not taken regularly. Integration is still a problem although partial solutions exist, for instance, by Tunstall or Telehealth, whose Healthium is an integrated remote health monitoring system, including video phone, blood pressure, glucose and pulse oximetry monitors as well as spirometer, weight scale and reminders.
* **Alarms and notifications:** Alarms may be aimed locally for the patient or carer and, for instance, play a reminder in a familiar voice, or remotely (telecare) to carers or to a professional monitoring center. A two-way voice call is usually made to determine if help is needed.
* **Data fusion and decision support:** Collecting data over a longer period of time from multiple sensors helps to make more complex decisions and avoid wrong alarms. Some devices provide a summary of patient’s activities (e.g. Vivago).
* **Memory assistance and exercise:** Reminders range from simple timers to more flexible smartphone applications (e.g. BrainAid PEAT soon available). Brain Age software for a portable Nintendo game console assesses and exercises memory and other cognitive skills. A neck camera (Vicon Revue) worn in precious occasions automatically takes every 30 seconds a photo of what the patient sees and watching the images afterwards helps to remember the occasion. Multimedia software can be used for evoking memories and stimulating conversation.

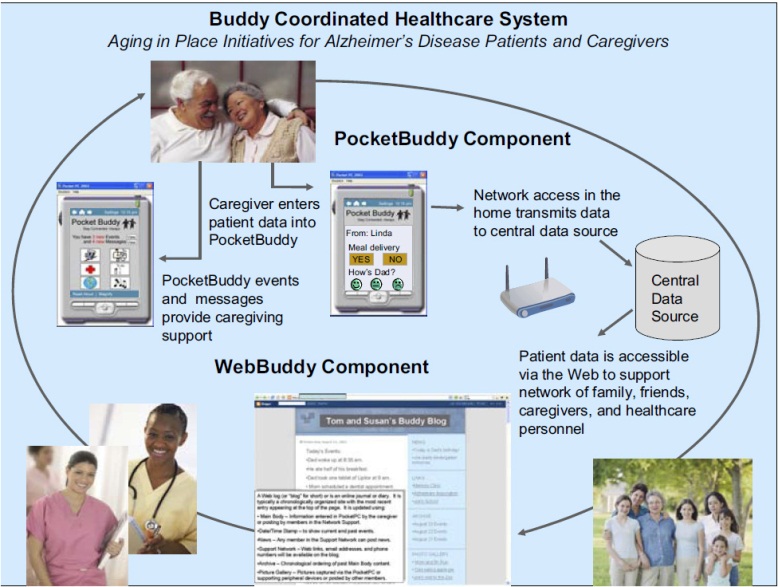
Smartphones with a range of built-in sensors and application distribution systems are getting more common and more powerful and are thus potential components for assistive technology systems.

A study of the acceptance of wearable technology by people with Alzheimer’s disease (Mahoney, 2010) found ten products suitable for patients with wandering tendencies but concluded that there is no ideal solution available and opportunities remain for marketplace innovation, in particular low-cost, waterproof sensors with longer battery life and better system interoperability.

Exploitation of results is described in section 3.5.

**Some products for dementia care in the US and in the world**:

* LoJack SafetyNet offers a tracking system for Alzheimer's patients who may wander off and have trouble finding their way home again. SafetyNet uses the Lojack Radio Frequency technology.
* Omnilink provides a wireless tracking service for Alzheimer's patients running on a Qualcomm handset. It's a location-based tracking service for people with Alzheimer's to allow caregivers to keep track of their patients and keep them from wandering.
* Healthsense eNeighbor offers a more comprehensive service. Battery-operated Wi-Fi sensors include pressure sensors in beds to detect when a patient gets into or out of bed, motion detectors on walls to detect movement or inactivity, sensors to monitor toilet usage, contact sensors on kitchen cupboards and refrigerator doors to monitor whether the person is eating regularly, and door sensors that alert when a person tries to leave home or enter potentially hazardous areas like stairways.
* The PocketPC (PocketBuddy) provides portable, non-invasive support for gathering data about the Alzheimer patient and the caregiver during daily caregiving activities. PocketBuddy is capable of recording behavioural and emotional changes observed by the caregiver. Using Web technology, data can be made accessible to a virtual network of family, friends, and healthcare professionals.



* LUMOSITY: Brain games and activities provided by online software products like Lumosity may help increase and improve speed, attention spans, problem solving skills, memory and ability to learn new tasks. Lumosity is a subscription-based product that encourages seniors or those wishing to increase their brain function between 20 to 40 sessions every day. Games take about 15 minutes to complete and can be catered to specific needs such as memory enhancement, reasoning speed, mental functions or recognition games, among others. <http://www.lumosity.com>
* My Life Software: My Life Shared And Personal Growth's DRTS was specifically designed for ease of use. We recommend our software is used with touch-screen technology, as it makes the whole reminiscence therapy session interactive. However it can be used with a mouse and keyboard if you wish. <http://mylifesoftware.com/?page_id=194>
* Brain Fitness Software by DAKIM: The first dementia-fighting brain fitness software for seniors will soon be released by Dakim, Inc., developer of the #1 brain training system used in senior living communities. The new Dakim BrainFitness software edition helps the post-55 generation maintain mental acuity with the same entertaining, scientifically based activities. <http://www.prnewswire.com/news-releases/brain-games-for-seniors-dakim-offers-1st-brain-fitness-software-aimed-at-fighting-dementia-80912912.html>
* Posit Science: Posit Science claims that their products will help the user "think faster, focus better, and remember more." Their software programs are designed for either a PC or a Mac. <http://www.insideeldercare.com/assisted-living/top-brain-fitness-programs-for-sustaining-mental-acuity>
* CogniFit: CogniFit is a web-based system that does not require you to install software or purchase a console. Instead you access the programs through their website.
* Ecumen At Home: Ecumen At Home and BeClose offer caregivers an easy way to feel secure about their loved ones using the BeClose Wireless Monitoring system with an easy-to-use web-based Caregiver Portal. How does it work? Discrete wireless sensors are placed throughout the home to track activity. Caregivers view information about activity in the home on a private web page or set up custom notifications to send alerts to mobile devices or email should anything be out of the ordinary. No need for constant worrying; the system will tell you how things are going, even when you're on the go. <http://ecumenathome.org/technology>
* A Dundee PhD student has developed a computer program that helps dementia sufferers communicate with their carer. <http://www.bbc.co.uk/news/uk-scotland-tayside-central-15835831>
* Dr. Gemma Webster, 25, created software that holds a "multimedia biography" of the patient which carers can access through a touchscreen. <http://www.lancs.ac.uk/sci-tech/news/?article_id=1245>
* Melabev: Savion, unique computer software of mental stimulating exercises especially for the person with dementia. The purpose of the program is to give the client challenging and exciting tasks to do in four areas of cognition math, language, shapes and a memory game. <http://www.melabev.org/posts/60> , <http://www.israel21c.org/health/memory-enhancement-that-works-for-alzheimers>
* GPS tracking system unveiled for Alzheimer's patients: The Alzheimer's Association has unveiled a new Web-based application that works with various mobile devices to track people suffering from dementia who may wander off at some point during their illness. The association's Comfort Zone service was released earlier this month and is powered by Omnilink tracking services. It is the first comprehensive location management system designed specifically for Alzheimer's patients. <http://www.computerworld.com/s/article/9140138/GPS_tracking_system_unveiled_for_Alzheimer_s_patients>

**Market Opportunities:**

**ACTIMAGE FR** is currently starting to develop a line of e-health products, starting with the diabetes follow-up smartphone application Actelin. We are being also involved in other ITEA and AAL projects contributing to deliver such products to the market. The company has two kinds of opportunities: bring a fully owned and developed product to the market, such as Actelin, or as a partner in the development of a common product. Not having a reseller network, the applications we put on the market are typically smartphone apps going through the regular app stores. In the case of DEMWatch, it will be “spin-off” applications pursuing the first results of the project, especially on the environment-based serious gaming aspect or remote follow-up. Numerous use cases will emerge from the first tests, and won’t be in the scope of the project, thus offering opportunity to bring extensions on the market. We will also be part of the most global entry on the market of the global DEMWatch solution, contributing to its spread on the French market through the contacts we have, in medical institutions especially.

**ACTIMAGE LU** is involved in Data Management and Analytics which will bring the company a fresh expertise on this hot topic. Also, this hardware related project is capable of making new ideas emerge for further services and technologies for our client. A new kind of product can be created and sold by the company within four years after the end of the project. It will also enrich the company’s set of health products it is starting to constitute, through implication in other collaborative projects.

**TURKCELL:** According to the Alzheimer Society of Turkey, number of people having Alzheimer is estimated to be around 400K. As the population gets older, this number will quickly increase in Turkey. Health is the most important and strategic vision of TURKCELL in its R&D operations. Currently, a communication module is in use in several health kit applications, and we would like to extend the capabilities of this communication module to provide indoor and outdoor localization to patients, be the first telecom operator in Turkey to establish co-operation with hospitals and health care centers. For this reason, we brought in Ankira to be DEMWatch partner, one of the leading a software solution provider to more than 200 hospitals in Turkey.

**TTSA**, through its Forthnet S.A. parent company, has entered both the telecommunications and network services business, being a convergent services provider offering from voice telephony to Internet and value-added services over its private broadband network. The approach of the department of R&D in TTSA is market-driven, aiming a) to deliver prototypes, experimental results and proofs of concept for application of innovative technologies into eServices and networking and b) to transfer know-how and smooth transition of production and commercial activities to newer technologies and services. It also designs, develops and evaluates the application of modern services management through operation support systems.

The market strategy aims at linking the project goals with the long-term business and research goals of TTSA. Through the DEMWatch project market exploitation framework, potential target groups in different sectors will be identified, analysed and prioritised according to commercial attractiveness of the project’s results. The commercial exploitation activities will be focused on early adopters among customers, in order to optimise time-to-market, while also expand the existing smart living and alert messaging services. The outcomes of the DEMWatch project, comprising of a unified platform, can be distributed through the TTSA’s (Forthnet) network of clients and associates.

**BOR** is a software solution provider on Enterprise Web2.0 solutions, GIS Systems, Mobile and Video applications. DemWatch is a very good opportunity to combine its areas of expertise together to give sustainable and robust solutions on Dementia related applications. Dem Apps will include GIS integration (tracking), video storage and publishing (human security), mobile apps (both for patients and their relatives) and Web2.0 portals. Even though Turkey’s demographic structure points to youth, there are respectable amount of dementia patients and serving them with intelligent software systems will be a new market.

**Ankira Ltd.** sees a valuable market in healthcare, as the number and needs of dementia patients is growing worldwide. We believe that Turkish market will develop in parallel.

In Turkey, Ministry of Health has finished the legislation basis about wearable patient sensor devices in hospitals. This study already has a standard definition for wrist-worn patient locating wireless devices for state hospitals. The definition was enhanced with additional scenarios for emergency code situations and remote vitals and man-down sensing of recent date and this definition is also open for future enhancements. A total of one thousand state hospitals hold a developing market for such mobile wireless devices. Ankira Ltd. will have a marketing effort for this market and sees a top-notch opportunity for DEMWatch within this product portfolio.

Ankira Ltd. will have market developing efforts of our products and services in nursing homes, rehabilitation units and personal home-use in the next few years. In that sense, DEMWatch project holds many opportunities for us.

**CEA:** The indoor and wireless sensor networking solutions that will be developed during the DEMWatch project will be protected by patents. After submission of the necessary patents the project results will be presented at international conferences and may be published in scientific journals. CEA is a governmental applied research institute that does not directly exploit the outcome of the research, but licenses for CEA intellectual properties are granted to industries. The transfer of CEA Technology can either be done through licenses or through the creation of spin-off companies. As follow-on possibilities for its contribution to this project, CEA intends to exploit the DEMWatch platform preferably via a partnership with the ERMES DEMWatch provider partners.

**everis Aragón:** This project gives everis Aragónthe opportunity to create a product **using a European standard of interactive TV with large penetration and manage a differential product** to be offered to our clients. Main kind of possible clients where we will be able to exploit the results of this project are:

* Public and private hospitals
* Social caregivers companies
* Elderly people residences
* Private insurance companies

everis Aragón’s initiative within the part of mobile is on one hand, offering services destined to patients in an early stage of the illness and on the other hand, it like to offer a competitive and low cost solution for caregivers so that they can be less overwhelmed, win more independency and increase their mobility.

An in- house MDM solution could be used by our possible clients (insurance, hospitals, social care) between their employers and between their relatives. An estimation of our planned incomes directly or indirectly from this project result is 800.000 € in 4 years.

**ITA:** DemWatch project is going to gives us the opportunity to continue developing some of our investigation lines as a Research Organization like Interactive Tv, Multiplatform access, Computer Vision, QoE and usability, Autonomous Intelligent Systems and Virtual Agents.

Our intention to the project is also to intensify the tele-care and AAL market line of ITA, to continue developing our research work in this topic. ITA is going to continue the work in artificial intelligent and virtual agents to improve and evolve our developments in intelligent and decision support systems. On the other hand ITA has a PhD working in Computer Vision Techniques who gives to the project the possibility to apply the research results in this subject to other national and international projects in the future.

Due to DEMWatch project we could make a demonstrator collaborating with several companies and a Hospital, making possible the proximity with the end user, and how our developments are used and tested by them.

This will allow ITA to gain more knowledge which will be transferred to the companies working with ITA improving their competitiveness.

**FORTEC:** In Europe, about 7, 3 million people are affected by Alzheimer´s disease (AD) and other related disorders such as vascular dementia.

We face an emergency and we have to do something about it”, the president of ADI, Daisy Acosta has stated. “The life expectancy is increasing and, because of that, the number of senile Dementia’s patients, rises too”, she added. Unless scientists have substantial finding on prevention and treatment of this disease, ADI estimated that, in 2050, there will be 115.4 million people in the world affected by the disease, which is characterized by a progressive deterioration of the intellectual capacities, including memory, learning, direction, language, understanding and judgment. The condition is fatal and mainly affects to people majors of 65 years.

According to previous studies, about 85% of the primary care that old people receive do not come from the professional health systems, but is provided by their own families.

Caregivers are considered as the “secondary” victim of the disease, since they have to deal with a really heavy charge, both psychological and physical, as a consequence of his/her activities. As a result of this, the main lines of research have tried to identify the more influential variables in determining the discomfort of caregivers.

Senile dementia’s patients require systematic cares that allow their feeding and hygiene, avoid accidents and control their conduct. And, in addition, if families or caregivers encourage them to do physical and social activities and some kind of cognitive training, patients can face better him/her situation. But, generally, caregivers are not trained for such a complex and longtime situation, so they have to be adequately advised, oriented and trained on the characteristics and evolution of the disease. For instance, they must know:

* What to do in a case of patient’s state of agitation or aggressiveness.
* Required frequency of feeding in old people.
* The necessity to emphasize the capacities still conserved by patients.
* Required hygienic practices in old people.

Considering the diverse cultural and socioeconomic level of caregivers, training strategies should follow a universal, intuitive and understandable method, suitable to any condition.

According to the described scenario, there are two main conclusions:

* There is an increasing necessity of training for assistants and caregivers of people with senile Dementia. Assistants and caregivers need to be trained in competences and skills that prepare them for giving an adequate treatment and attention to patients and, at the same time, which helps to preserve their own psychological wellness. Currently, it is estimated that, in Europe, there are 7,3 million of patients, a number that will continue its raise during the next years, making that social and health assistance to senile Dementia’s patients will become one of the most important forthcoming social and health challenge.
* Tele-training is the most suitable strategy for obtaining a high level of impact in training caregivers, given its possibility of being a channel for a massive diffusion of standardised knowledge. Regarding the pedagogical methodology, given the before mentioned circumstances and characteristics, play-learning is the most recommended method for knowledge transmission, with a raising practice in adult training and very suitable in the case of collective with diverse cultural levels and languages.

**ARDIC:** Foreseeing and witnessing the growth wave in mobile device usage; we will integrate the work we do for DEMWatch with our platform. This platform already targeted a service platform with a large number of tablet devices that will be put in daily and essential usage both at home and at school. Parents of the students will already be familiar of the mobile devices and their usage.

Successfully deployed platform services over these mobile devices will build up trust among the governmental institutes. We believe that the DEMWatch will spread in usage by this public health organizations and institutes. Turkey (with a very large number of technology users) is a perfect Market for this project. This provided mobility in any small, portable device will help the people with slight and moderate memory disorder as well as their caretakers and families.

**IC Neuronic** has a long experience in developing medical and diagnostic devices. We expect to use this project as an opportunity to start a new line of products in a field where we expect there will be an increase of the market as the population average age in Europe gets older. Having a public demonstrator for the technology will be a major enabler for selling cutting edge technology, and to have the backing of public institutions like Barbastro’s Hospital for the project is also a very good opportunity.

## Innovation

In DEMWatch project, technological and business innovation is offered in the following areas:

* Prevention or delay of the dementia with technology assisted memory improvements, which is actually about the **memory disorders rehabilitation**
* Technology assistance during the care of a dementia patient (which is not to confuse with any treatment, this is just **location/ context monitoring and reporting**)
* Communication with the dementia patient through a **Multimodal Interface** and **Multiplatform access to the contents** (iTV, mobile devices, etc.)
* **Add new elements to the patient environment: interactive television at home. TV environment,** brings to the patient an easy and accessible interface which is known, and usually used by them. There isn’t any development using the interactive TV standard (**hbbtv**, **Hybrid Broadcast Broadband TV, is being promoted among Europe**) to **integrate** techniques to provide prevention and assistance to this kind of patients.
* Technology connects people with similar problems to each other in order to give peer support and to improve the social life of people.
* Instructions and informative data are offered through new technology to patients and their families.
* Technology provides long term information about the status of patients to the care takers.
* Serious gaming solutions provide assessment of early memory disorders, helping identify developing dementia earlier, which make it possible to start countermeasures and adaptation in time.

### Technology

**Memory Disorders Rehabilitation**

In the rapidly aging societies more and more older adults are seeking for different ways to keep them active and alert. There is a clear growing market and business opportunity for the computer game industry for the older adults. It is also easy to predict that these kind of applications and uses of technology will emerge as baby boomers age. Nowadays, a growing number of companies are marketing computer programs and games that they say will help aging people stay mentally sharp and perhaps ward off inevitable decline and lurking dementia. The applications are targeted at one of the fastest-growing segments of the game market: people over 40 worried about losing their mental edge. Although there is not yet direct evidence that increased mental activity can slow the decline in the brain, millions of memory games have been sold so far in Japan, USA and Europe. The debate around brain training is heating and results from academic research are desperately desired.

An innovative aspect is the usage of a brain game as an assessment tool for memory tests and training. Developing these kinds of rehabilitation and assessment tools demands close cooperation between researchers in the area of human and cognitive sciences and interaction technologies, as well as validated empirical studies and user tests. In the early 1990s Merzenich and others discovered that the brain remains plastic throughout life, and claimed that with training, it can be rewired to learn new skills. From this discovery grew the belief that the aging brain can be taught to be “younger” again. Mahncke et al. suggested in 2006 that a brain plasticity (the brain’s lifelong ability to remodel itself as you learn and remember) -based training program can significantly improve cognitive function, and memory in particular, in mature adults with normal age-related cognitive decline. Some studies have shown that training in memory, reasoning, reaction time, or other mental skills helps people perform better on tests of those skills in the short-term. Klinberg and others go a bit further in suggesting that short-term memory can be improved by training and that such training helps people with attention deficits and also improves reasoning ability overall. In their studies, after training, measured brain activity related to short-term (working) memory increased in the prefrontal cortex of the persons, an area that many researchers have associated with short-term memory functions. Willis et al. examined in a five-year follow-up study the effects of cognitive training on daily function and durability of training on cognitive abilities of independently living US citizens (mean age, 73.6 years). The interventions were training for memory, reasoning and speed of processing. The rigorous study suggests that brain training could positively affect daily-life activities and might delay age-related declines in everyday functioning. Cognitive training resulted in improved cognitive abilities specific to the abilities trained that continued five years after the initiation of the intervention, and training in reasoning resulted in significantly less difficulty in the instrumental activities of daily living (IADL).

Empirical studies of ageing and memory show that elderly people maintain the ability to acquire new information and strategies. Several studies of elderly in community-dwellings suggest that cognitive restructuring techniques may help community-dwelling older adults improve their memory functioning, gain control over their beliefs about memory and thereby enhance their memory performance.

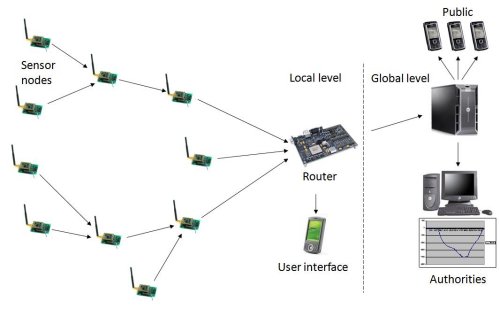
**Design methodology**

The DEMWatch project introduces a HTI-design (Human-Technology Interaction) methodology called Life-Based Design (LBD). The principal aim of the methodology is to release technology that will be widely accepted by people (Leikas 2009; Saariluoma and Leikas 2010; Saariluoma and Leikas 2011). This is realized by a thorough exploration of people’s forms of life, values and everyday contingencies and an efficient integration of them into the design as the actual drivers of HTI-design processes. LBD is a multi-dimensional and holistic approach, which emphasizes the importance of understanding people’s lives as a basis for the creation of design ideas and for concept design. It derives design goals for new technologies from human research based on the analysis of forms of life. A holistic approach means that, fundamentally, all design issues in LBD are biologically, psychologically and socio-culturally motivated. Here, the methodology will be used to investigate the everyday life of people with memory disorders, their caregivers and relatives.

Here, the focus will be on diagnoses of memory impairment, its progress in the course of time, different rehabilitation practices and possibilities. It is also essential to investigate how memory disorders change the life of a patient and their relatives and if it would be possible to develop relevant caretaking procedures on the ground of this information.

**Location Monitoring and Reporting**

**Indoor -** Localization is a crucial and critical task for wireless sensor networks (WSNs), which has received substantive attention in recent years. A **Wireless Sensor Network (WSN)** is a network of many small sensing and communicating devices called sensor nodes (or motes). Each node has a CPU, a power supply and a radio transceiver for communication. Interconnection between nodes is achieved via the transceiver. Typically, a WSN contains one node, the base station that connects the network to a more capable computer, and probably to a network of general purpose computers through it. Sensors attached to these nodes allow them to sense various phenomena within the environment. The typical purpose of a sensor network is to collect data via sensing interfaces and propagate those data to the central computer, allowing easy monitoring of an environment.



**IEEE 802.15.4** is a standard which specifies the physical layer and media access control for low-rate wireless personal area networks (LR-WPANs). IEEE standard 802.15.4 intends to offer the fundamental lower network layers of a type of wireless personal area network (WPAN) which focuses on low-cost, low-speed ubiquitous communication between devices (in contrast with other, more end-user oriented approaches, such as Wi-Fi). The emphasis is on very low cost communication of nearby devices with little to no underlying infrastructure, intending to exploit this to lower power consumption even more.

DEMWatch project is going to use IEEE 802.15.4 standards for indoor localization.

**Outdoor –** One of the key issues of the DEMWatch system is to provide an accurate localisation of the person. Pedestrian localisation in a living environment includes outdoor and indoor positioning. In the outdoor environment, GNSS (such as GPS, GLONASS…) systems are widely spread and already available. But in the indoor environment, several technologies are under study. They can be divided in two main categories: those needing the building to be equipped (RFID, WiFi, Bluetooth) and those needing no pre-installed beacons (Dead-Reckoning and inertial navigation systems, magneto-inertial technology, vision based systems…).

The aim of the project is to develop a stand-alone system; therefore DEMWatch will focus on the technologies from the second category. Different approaches studied by some partners of the consortium and the state of the art will be compared; we can list:

* **Dead-reckoning and inertial navigation systems** are based on accelerometers, gyros, magnetometers, and barometric altimeters sensors. These are usually combined into a sensor package that is mounted somewhere on the person, usually on the torso or on the foot. The classical principle of inertial sensing is to calculate the localisation information by integrating rotations speed and acceleration measured by gyro meters and accelerometers. Nevertheless, inertial technology suffers from several limitations such as the localisation error due to the remaining signals biases. To improve such systems, additional sensors will be used (barometers, magnetometers, GNSS receivers, a map of the environment…). For the use in indoor environment, inertial navigation systems using MEMS technology (Micro Electro-Mechanical System) are of special interest due to their small size and relatively low prices.
* **Magneto-inertial** navigation is a new technique that aims at estimating the motion of the pedestrian in an environment where the magnetic field is spatially disturbed in a time-independent way. Magneto-inertial technology complements conventional inertial sensors (gyros MEMS accelerometer MEMS) by using a set of spatially distributed magnetometers that are attached to the pedestrian. Nevertheless, magneto-inertial technology suffers from several limitations such as the weight of the battery (approximately 5kg.), and its robustness to electromagnetic non-stationary (time-varying) disturbances is unknown.
* **Vision based systems** are mostly based on Simultaneous Localisation and Mapping (SLAM). The main principle of this approach is to build a map of the environment by the vision system and use this map to localise the pedestrian. Nevertheless, vision based systems suffer from several limitations such as computing time (heavy calculation which is not compatible with real time system), robustness under all lightning condition.

DEMWatch project is going to use GNSS standards for outdoor localization. The indoor solution will also be combined to GNSS for outdoor environment to provide a full reliable localisation system.

**Context Monitoring and Reporting**

The DEMWatch project incorporates **vision algorithms and video & image processing** for patient monitoring depending on the context in indoor locations. Visual sensors provide a huge amount of information which can be very useful, once it is processed, to the localization of people with dementia within in-home scenarios. Several techniques and technologies can be applied to track the user and to detect possible risky situations (2D cameras, 2D infrared spectrum cameras, 3D sensing and low cost 3D sensors). This kind of in-home camera based sensors enable to better understand scenes and also to improve the interaction with contents and users, like for example tele-care systems to monitor in-home incidents and to rack positions and actions as well as detection of user gestures to improve interaction. Positions of these sensors will also be determinant to enable the tracking of the people with dementia as well as to have the better places to detect risky situations. Based on the combination of Artificial Intelligent techniques and artificial vision is possible to better understand what happens in the scene by means of image and video processing techniques, scene and objects relevant features extraction, recognition and classification, pattern recognition, tracking of objects, as well as automated reasoning of the relevant features visually detected. Besides of that 3D information can also be included to offer additional information (depth information) which can also be applied to improve the accuracy and the better understanding of the scenes.

**Multimodal Interface**

The DEMWatch project will include a Multimodal interface with the Dementia person in order to provide the best solution that fits the dementia person. Moreover, **Artificial Intelligence** (AI) and **SoftComputing** technologies will be applied to look for new methods to improve the communication with the patient and the interaction and also for the generation of an intelligent **Decision Support System** (iDSS). The use of AI in the iDSS allows us to manage text, geographic information, medical information and subjective information and learn in high-uncertainty environments in a way similar to humans. Then the iDSS will manage and will monitor the dementia people to help medical and family people the current status of the person.

One of these AI main technologies that will be used is **Affective Computing**. This technology will be used to increase the humanity and reduce the gap between the user and the tele-care service. In this research line we will ~~be~~ develop an affective virtual agent; this virtual agent will be able to express basic emotions and interaction by means of the AI technologies. The virtual agent is believable: it moves properly, paying special attention to the semantic information introduced by the user, the information of the iDSS and has the capacity to talk and receive orders in natural language. Emotions have been proved to play an essential role in human interaction process. Consequently, besides its external appearance, the virtual agent for eHealth will have some affectivity and social affinity an innate characteristic in humans.

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The Platform to be developed during the project will allow taking information and evaluation from different dementia users and will take decision according to this information, suggestion and recommendations to the user.

**Multiplatform access (iTV, mobile devices)**

**Interactive television** will be used in DEMWatch project to complement a mass media already accepted by the society with additional broadcasting services. In combination with broadband IP networks, it enables a hybrid model where the dementia care services are deployed in a common way to the person’s in-homes or residences. In combination to IP communications with external servers, it guarantees a personalization of the services.

Last interactive TV like HbbTV (Hybrid Broadcast Broadband TV) will be taken into account in order to deploy the services. HbbTV is an open and business neutral technology platform that seamlessly combines TV services delivered via broadcast with services delivered via broadband and also enables access to Internet only services for consumers using connected TVs and set-top boxes. The HbbTV specification is based on existing standards and web technologies including OIPF (Open IPTV Forum), CEA, DVB and W3C and is being promoted among Europe. The standard provides the features and functionality required to deliver feature rich broadcast and internet services. Utilizing standard Internet technology it enables rapid application development. It defines minimum requirements simplifying the implementation in devices and leaving room for differentiation, this limits the investment required by CE manufacturers to build compliant devices. We will use this standard to integrate the techniques to provide prevention and assistance to this kind of patients. The main reason why it will be used is the extension across Europe so that the solution will be easy to exploit within the rest of Europe.

The complexity in this field is the integration to be done using Hbbtv with various systems and devices: monitoring systems, tele-care, video-messages, etc.

**Multiplatform access** to the contents by the final users is also considered an important topic, by taking into account formats compatibility, user interfaces adaptable to the platforms, and a usable access to the contents. Multiplatform access from mobile devices (iOS, Android) plays also an important role as a device where it is feasible to integrate applications offered to enterprises responsible for dementia care as well as relatives to be informed about relevant acts.

**Multiplatform development for mobile devices** based in frameworks like phone gap and mobile allowing less development and maintenance costs because only it is necessary to keep a code version for all mobile platforms.

**Serious Gaming** is an important part of the development of applications for rehabilitation and diagnostics. In a gaming context it would be possible to objectively measure the possible decrease in performance level over the time. It is also possible to provide people with information about their living environment and their life to support memory. This is why serious gaming technologies provide a good evaluation and rehabilitation environment for the project.

### Business

**Memory Disorders Rehabilitation**

To enhance the rehabilitation of memory disorders is an important social goal. Dementia care addresses a significant and expensive societal problem. Even slight memory loss has an immediate impact on the quality of life of the person as well as relatives or other near ones. Care is very labour intensive and often relies heavily on the involvement of unpaid relatives. With the help of assistive technology it would be possible to train large numbers of patients simultaneously and thus release time for human care takes to take care of the tasks which cannot be moved over the technologies.

Some potential products that DEMWatch could ease the dementia care and memory rehabilitation could be:

1. There isn’t any development using the **interactive TV** standard (HBBTV, Hybrid Broadcast Broadband TV, is being promoted among Europe) to integrate techniques to provide prevention and assistance to this kind of patients. This part is differential if we think of usual services to be provided by any private or public caregiving entity. So, this opportunity brings new business cases to be offered to health and social entities so that we can contribute to reduce their costs and give a known and easy-to-use interface for patients.
2. **Prospective Memory Aid:** Memory Glasses. Memory Glasses is a context-aware memory aid that is embedded in glasses. The goal of the system is to deliver reminders to the wearer in a timely, situation-appropriate way, without requiring intervention on the part of the wearer beyond the initial request to be reminded. This system is different from passive reminder systems, such as a standard Personal Digital Assistant, which cannot know the user’s activity context. Memory glasses leverages variety of computer perception techniques, based in part on captured visual images, which permit context awareness.
3. **Fall Detectors:** Although both manual and automated simple alarm systems exist to alert caregivers of a fall, the automated ones must be worn at all times, and the manual ones require the user to activate the response system in the event of a fall.
4. **Video and Sensor Analysis for Geriatric:** Capture in real-time, continuously video/audio data that were processed to identify normative behavior, and aberrant low frequency, high impact behaviors such as falls, physical, and verbal aggression that often escape detection by non-continuous recording methods.
5. **Assistive devices that prevent wandering** such as sensors that can be placed on walls or on doors to alert caregivers if someone opens a door. RFID tagged wearable device for home use that activate an alarm, shut a door that has been pushed open, and/or alert designated responders -- aka 'departure alert' systems.
6. **Bed/ Chair Occupancy Sensor:** This specially designed pressure pad fits under the mattress and provides an early warning by alerting that the user has left their bed and not returned within a preset time period, indicating a possible fall. The sensor can also be programmed to switch on lights, helping people find their way to and from bed easily.
7. **Medication Reminder:** Provides an effective solution to support medication compliance by automatically dispensing medication and providing audible and visual alerts to the user each time medication should be taken. If the user fails to access the medication, an alert is raised to the monitoring center or designated caregiver.
8. **Activities of daily living monitoring:** Provides an unobtrusive method of capturing a person's behavior patterns so if a deviation from the norm occurs, it can be identified, the cause investigated and preventative action taken.
9. **Remotely chargeable assistive devices that help locate people who are lost.**  These systems are small GPS units that can be carried or worn to help caregivers and emergency services personnel track people who may have wandered away from home.
10. A **wearable camera that stimulates and rehabilitates autobiographical** memory by capturing an electronic record of the wearer's day. It does this by automatically recording a series of still images through its wide-angle lens, and simultaneously capturing a log of data from a number of built-in electronic sensors. Subsequently reviewing a sequence of images appears to provide a powerful autobiographical memory cue.
11. Better tools for the assessment and rehabilitation of memory disorders
12. More personal selection of assistive technologies based on Life-Based Design
13. Patient monitoring products with better privacy and less false alarms
14. More user-friendly, personalized interfaces for tele-care services
15. Serious games for the evaluation and exercise of cognitive performance

## Expected results and impact

### Technology

There has been some earlier research projects aimed to develop ICT-support systems for memory disorders. They illustrate that it is possible to reach real results in this area with a project closely related to industry with practical interest on the dementia and memory disorder issues. However, no commercial break through is possible without active industrial involvement. This is why it makes sense to investigate and develop these technologies in ITEA-2 contexts.

The project allows us to generate and elaborate the principles of human-technology interaction design, and especially user-centered design. The question is no longer about how people can use technologies but how we can best design, incorporate and implement new technologies for the use of substantially large groups of people in their everyday lives. Life-based design opens up such new processes. This is an important problem as an increasing part of value produced by technology innovations is based on the ability to adapt multifunctional technologies in new ways. The development of ICT-services presupposes not always dramatically new technical advancements but also finding new practical applications for them.

As we don’t have fully marketing insight of the project’s technological results, we can comfortably say that technology assisted memory rehabilitation techniques, use of interactive TV integrated into tele-care services, location and context sensors and monitoring applications will target the dementia patients in project participator countries first.

As for Turkey, the elderly population forms 5 % of the total Turkish population (70 mi.) and community studies have shown mild dementia in 2.6-20 % and severe dementia in 1.3-6.2 % of the elderly population. In Turkey most patients suffering from dementia are cared for at home by an informal caregiver. The burden upon informal caregivers of mentally ill patients was first acknowledged by Grad and Sainbury in 1963. Today it is widely accepted that providing care for a relative with dementia can be a potent source of chronic stress and can cause deleterious consequences for both the physical and emotional health of caregivers. The incidence of depression among caregivers ranges between 18-47 % in different studies, therefore most of the research has focused on the psychologic well-being of the caregivers. - Parks SM, Novielli KD. A practical guide to caring for caregivers.Am Fam Physician 2000;62:2613-20.

DEMWatch’s project’s technological results will be majorly:

* Methodologies and technologies for cognitive state assessment (self-assessment, games, analysis tools)
* Memory support applications and services, games for memory training and assessment
* Low cost Indoor and outdoor localization and communication systems
* Applications and services using novel technologies such as interactive TV, wireless sensors, etc.
* Energy Harvester capability equipped wearable devices

We are expecting project results becoming available in medium term. Project starts in mid of 2013 and targeted to finish at the end of year 2015. The success criteria of DEMWatch project is going to be measured via number of dementia patients using the resulting products and services, plus, how satisfactory it is to meet their expectations and needs. Each project participator country will do its own assessment in solution evolution.

Cost saving figures will be especially in smart devices reporting location and context as they will be developed in low power consumption and re-chargeable concept. Memory support applications will delay the deterioration of the cognitive skills of elder people and improve their quality of life. Usability and quality of services will be measured periodically in co-operation with specialists of dementia domain.

### Business

Dementia care addresses a significant and expensive societal problem in EU countries. They feature a number of SME companies in this field that the project can help to grow to international potential. DEMWatch has good opportunities to get a solid foot hole in the growing markets opened by dementia and other memory disorders. The clients are people suffering from memory disorders, their caregivers, and relatives. The parties interested in utilizing the results of the project will be smart home system manufacturers (additional application domain and services for their systems), serious game developers (enhancing their repertoire for this market), occupational health providers (improved tools for rehabilitation), elderly care providers (providing care more efficiently with lower costs), and finally, memory patients, their relatives and caretakers (individuals will be ready to purchase solutions if their quality of life can be improved), especially active older adults who are in the edge of losing their memory and seek for different ways to keep active and alert.

### Standardization strategy

Indoor/ Outdoor localization if one of the major focus of the DEMWatch project. To standardize the works done in the project we are envisaging to build a kit which containts communication module integrated with GSM and 802.15.4 (i.e Zigbee, 6LoWPAN) radio interfaces and allows free software development platform. We are going to design communication module to be a general and extensible M2M application development platform. Communication module is going to available for components expansion for other physical network interfaces such as Ethernet or new sensors with different communication protocols to be added. The DEMWatch kit is going to be a free development environment; Embedded System platforms are generally subject to high cost of development. DEMWatch’s kit’s environment is chosen to be especially open source to ease the development for Software Configuration Management Engineers (SCMEs). The DEMWatch kit for localization will also include open source driver software for peripherals and ready to use application templates.

TURKCELL is in continuous co-operation with the research academics in Turkey, setting the targets, doing the R&D works and standardizing to be in compliance with the academics’ and disseminating the results to a broad range of professionals in its R&D eco-system through monthly based TURKCELL Technology bulletin and quarterly TURKCELL internal and external communication bulletin.

We expect highly positive impact of the project results in terms of technology assistance in memory improvement for dementia patients and their care process. Assistive technology has potential benefits for people with dementia providing it is introduced early on in the care of an individual with dementia and is tailored to each individual's needs.

For example, it can enable people to live independently for longer, reduce stress on people with dementia and caregivers and can potentially enhance the quality of life for people with dementia and give them greater choices about their care. For caregivers, there is evidence to suggest that since the introduction of tele-care in to their caring situation, they have benefited from more peace of mind, a better night's sleep, improved the relationship with the person(s) they cared for, the opportunity to continue with activities they might otherwise have to give up, the ability to remain in paid employment in some cases, and more confidence about the safety and comfort of the person they cared for.

While assistive technology has potential benefits to offer people with dementia there are still a number general issues around the provision of assistive technology that need to be explored in more detail and addressed such as improving interaction, personalized care, limitations, ethical considerations. DEMWatch is targeting to address these areas of improvements.

During DEMWatch project, we are going to run assessments on what we are going to offer as technological assistance to patients at the beginning stage and caregivers of patients at further stages and get their feed backs on a questionnaire basis. At the end, we are going to run the assessments about the results of the project, how their life changed and what improvements gained in quality of life of the patient and the caregiver. We are going to publish these results as deliverables from time to time during the project period. To be able to reach and understand end user better, project team on board has Proffessor Pertti Saariluoma from JYU who is specialized in cognitive sciences same as Dr. Jaana Leikas, working at Active Aging Department of VTT, member of   
AALIANCE - The European Ambient Assisted Living Innovation Alliance and [**Gerontechnology (ISG)**](http://www.linkedin.com/groups?gid=1945469).

The project plans to make use of existing and emerging standards in the relevant fields. At the level of methodology, we plan to rely on ISO 13407, titled Human-centered design processes for interactive systems. This ISO Standard provides guidance on UCD activities throughout the life cycle of interactive computer-based systems. At the level of designing concrete user interfaces, we plan to consider different relevant guidelines and styles. ISO 9241, for instance, defines ergonomics of human-system interaction that can serve as the basic framework within which other more specific approaches and guidelines can be incorporated.

## Dissemination and Exploitation of Results

### Dissemination

In order to bring light on DEMWatch, it is crucial to let a broad audience know of the aims of our work and give them the opportunity to test and spread it to their own audience. The audience includes:

* Medical academics and practitioners
* Occupational health providers
* AAL-related academics and practitioners
* AAL industries and SME
* End-users and their families
* Hospitals and nursing homes

Specific actions to reach each audience have to take place to guarantee maximum impact. A specific attention must be placed on opinion leaders (at European and/or national level) for each audience. For example the following instruments will be used:

* Scientific conference and journal papers in medical, psychological and engineering domains
* Workshops and international conferences on related topics, such as :
  + International Conference of Alzheimer’s Disease ;
  + UK Dementia Congress ;
  + Annual Congress of the “Société Française de Technologies pour l’Autonomie et la Gérontechnologie
  + The World Conference of Gerontechnology
  + Serious Games Conference
  + European society for cognitive psychology
  + Psychology world congres
* Private event held by a particular partner for his purposes
* Demonstrators as basis for the development of real products and services
* Public announcement in newspapers and on the Internet
* Websites of the consortium partners

The partners will all contribute in the dissemination process at their own scale and this directly at the beginning of the project.

As a PME, **ACTIMAGE FR** doesn’t have a vocation of publications in scientific reviews. As an IT professional, we will however take part in the reflection groups about standardization, bringing our field expertise on these issues. Actimage will also develop and administrate the project website.

**ACTIMAGE LU** is part of the AAL community in the country. Two dozens of SMEs, RTD performers, universities, foundations and industries invest in eHealth and AAL. This is a path encouraged by the Luxembourgish government. ACTIMAGE can organize a workshop and a dissemination meeting in this interesting environment.

**TTSA** will be involved in the dissemination of the results within the IT community, the business community, and the general audience. The dissemination activities will ensure a good flow of information that will contribute to the establishment of recognition of DEMWatch project, In particular, the potential benefits derived from DEMWatch project results will be highlighted in the dissemination phase.

**BOR** will encourage at least one (probably two) of its employees to study on DemWatch at graduate level at Bilkent University or METU. This will help us to disseminate project on academic level with journal articles, conference papers, and workshop presentations.

**CEA:** For the dissemination process, CEA intends to publish relevant results through scientific journal or technical conferences. Finally, the knowledge gained from the project will also be used to identify new research challenges for the future research activities; and the fruitful collaborations with European industries and academic established through DEMWATCH will surely pave the way to future research projects. Further dissemination will be done through various media such as the project website and demonstration of prototypes and results on technical fairs and end-user related events.

**everis Aragón:** As an international company it will extend the objective and the results of this project among its different offices and at marketing events the group could manage. everis Aragón will be taking active part at the exploitation plan because it would like to manage a competitive product. For this is important to get a great agreement within the partnership.

**TURKCELL:** TURKCELL has one of the most effective and biggest businesses eco-system in Turkey where it contributes business models and technology perspectives to support both technological and business growth of partners in the eco-system through trainings, consultancy, documents and common projects. TURKCELL will disseminate the results of DEMWatch project through its partner program’s blog, wiki and newsletters as well as periodically published TURKCELL Academy’s bulletins for public information. Besides, TURKCELL cooperates with well-known national and international universities particularly within the fields of applied research and EU projects. R&D reports are also being delivered to the academics in a regular basis.

**Barbastro’s Hospital**, due to its nature as public health services provider interacts with a wide range of environments where to disseminate the project. The Hospital can broadcast DemWatch on the technological health environment inside the centre and onto the regional Health Organization (SALUD) that the hospital belongs to, between the sanitary managing leaders, social organizations and patients and carers regional associations (especially among Alzheimer associations that have a very intense activity and can also provide patients to study). Barbastro’s Hospital is very active in the participation in National Spanish events and specialized congresses due to our work in several other European projects, and where we can spread DemWatch work and results. Furthermore, dissemination activities can be done in the academic level as a possible contribution to doctorate degrees

**ITA:** As a Research Organization, the dissemination activities of ITA will be focused on publications in scientific journals and participation in international conferences showing case studies to the ICT community through papers and possible workshops, stakeholders and end users. Our dissemination and exploitation objectives in DEMWatch project will include the participation of one PhD which allows publishing the results in at least two paper submissions for relevant conferences.

**FORTEC:** In order to increase the diffusion of our products and promote their use by interested institutions, it has been developed a diffusion programme. This programme is divided into two sub-programmes: 1) the On-line Diffusion and Transfer Sub-Programme, making use of social media and Web 2.0; and 2) the Off-line Diffusion and Transfer Sub-Programme, looking for institutions and organizations interested in the products resulting from the project.

**On-line Diffusion and Transfer Sub-Programme**: Social media and Web 2.0 applications will be used for sharing information regarding the objectives of the project, main results and conclusions, as well as a detailed description of the final products.

In particular, the following tools and spaces will be used for specific goals on each case:

**Facebook**: Existing groups related with the issues of the project (university researchers, therapists, caregivers and other related workers) will be contacted. It will be created online events, aiming to spread out the information obtained as part of the project. These events would try to create synergies among participants and become spaces for the interaction between the different profiles related with the issue (non-professional caregivers, professional assistants, etc.)

**Twitter:** It will be mainly used for bringing both existing followers and potential ones towards the groups, events and discussion forums created.

**LinkedIn:** In this case, existing and active groups will be used in order to contact persons and institutions, and also for spread out the results of the project in professional environments.

The aim of all these above mentioned activities would be to create a viral loop based on the information and results obtained as part of the project. Obviously, in order to facilitate the transfer of the results, it will be given the possibility of the most direct and immediate contact with the Technical Coordination to those people interested in a more thorough information.

Web 2.0 tools to be used:

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| FACEBOOK | TWITTER | LINKEDIN |

**Off-line Diffusion and Transfer Sub-Programme:** The objectives of the projects, its main conclusions and a description of the final products will be communicate to institutions previously identified as potential users of the final products developed. They will be contacted by email, telephone or personally if possible.

At least, the following institutions will be contacted:

* Residences and care centres related with senile Dementia.
* Hospitals and, specifically, those areas related with the prevention and treatment of senile Dementia.
* Associations of families of people with senile Dementia.
* Labour unions and business organizations representing professionals of health and social care specialised on the treatment of senile Dementia.
* Public organizations involved on asocial assistance activities to patients affected by senile Dementia.

Through these two sub-programmes, direct diffusion and diffusion by social media, it is estimated a potential impact of both first and second level, over more than 2000 people or institutions.

The final product to be commercialised is a didactic material, as a serious game for the training of caregivers and professionals, as well as workers from social, welfare and health organizations. For FORTEC it means the possibility for spreading out its potential market with an innovative product that clearly fills a rising social demand, given the increase of life expectancy and, consequently, the growing number of patients affected by senile Dementia.

**ARDIC:** As a R&D company established in a technology free zone of the Scientific and Technological Research Council of Turkey, the best way to publish the project is presenting the results to the Council. This top academic council’s approved projects are always very much acknowledged by universities, government organizations, public institutes and most importantly by visual and print media.

Making videos and having them published by technology web sites like “Engadget” makes the company and the project very much recognized. The effect of these videos can easily be measured by the hits to the site per day and the watch rate of the videos. We highly and interactively use the social media over Facebook, twitter and linked in as well as our up-to-date web site.

**IC Neuronic:** IC Neuronic, as a private company working in the medical field will use its network of commercial partners and its customers to introduce them to the technology developed in this project. The existence of a demonstrator near our main facilities it’s a plus that will enable us to showcase the technology to prospective customers in a very straightforward fashion.

### Exploitation of Results

Partners will exploit the project results in specific ways, either in collaboration or on an individual basis. Three exploitation plans are presented and are able to give a potential return on investment for the partners.

1. Hardware companies could manufacture devices related to dementia in combination with software companies which create the software platform. A ready-to-use package can be sold to customers with a Software-as-a-Service architecture which will create a plug and play experience with a broad range of extension possibilities for the partners.
2. Industries and SMEs extend their product portfolio and sell their expertise to their customer base in the health sector. This can be done from a hardware point of view (health sensors and actuators) and from a software point of view (aggregators, software platform, data mining and analysis, data hosting, data security).
3. Research Centers and Universities which have strong binds to other scientific and research organisms will capitalize competencies in health-related projects. They will get new IP, processes, tools, methodologies to use in future AAL projects.

Specific exploitation expectations from the partners below:

**ACTIMAGE** is involved in Data Management and Analytics which will bring the company a fresh expertise on this hot topic. Also, this hardware related project is capable of making new ideas emerge for further services and technologies for our client. A new kind of product can be created and sold by the company within four years after the end of the project. It will also enrich the company’s set of health products it is starting to constitute, through implication in other collaborative projetcs.

**TURKCELL** is going to collaborate with elder care homes and hospitals through its partner, **Ankira**, who provides ICT solutions, services and products to a couple of hundreds of hospitals in Turkey. Turkcell is going to benefit from project results by expanding its know-how in geriatric disorders and extend capabilities of an open source platform development kit being developed for e-health.

**TeleMedicine Technologies (TTSA)**, through Forthnet S.A. parent company, has a strong interest in the exploitation of the DEMWatch proposed services to the relevant user groups. DEMWatch combines emerging sensor technologies with fast data delivery in order to provide critical services to end-users, while TTSA utilizes and integrates technological solutions on the basis of the latest telecommunication prototypes, in order to develop and introduce innovative services to the eHEALTH market, that encourage the use of medical-related ICT and broadband networks. Under this scope, mid- and long- term commercial exploitation of the DEMWatch project results, as well as the exploitation of the individual software modules will be investigated.

These will derive from the technological expertise that will be gained out of the research activities of the project, integrated with the core competences and business interests of the company.

The extended technological research throughout the duration of the DEMWatch project, along with the expected outcomes of the project will provide TTSA with further expertise, especially in the areas of sensor data acquisition, home automation techniques and the development of targeted mobile applications. The above will result in offering a richer and more advanced end user experience, utilizing TTSA’s infrastructure and customer base, while attracting new consumers.

**everis Aragón** will extend the objective and the results of this project among our different offices and at marketing events the group could manage. It will be taking active part at the exploitation plan because it would like to manage a competitive product. For this is important to get a great agreement within the partnership.

We will be pointed to provide mobile and interactive television solution for dementia patients. This project gives us the opportunity to create a product **using a European standard of interactive TV with large penetration and manage a differential product** to be offered to our clients. Main kind of possible clients where we will be able to exploit the results of this project are:

* Public and private hospitals
* Social caregivers companies
* Elderly people residences
* Private insurance companies

Our initiative within the part of mobile is on one hand, offering services destined to patients in an early stage of the illness and on the other hand, we would like to offer a competitive and low cost solution for caregivers so that they can be less overwhelmed, win more independency and increase their mobility.

**CEA:** One of the main missions of CEA-Tech is to develop innovative technologies and transfer these technologies and related know-how to industrials partners. As a first step, CEA plans to integrate the results of its contribution to the project in its related technology suites, in particular targeted to indoor-outdoor localization and wireless sensor networking for home or PAN, and to exploit these results through new technology transfer partnerships with industrial partners. When applicable, CEA might also consider the possibility to exploit its results from the project by influencing standardization (and in particular the IETF). CEA will consider the opportunity to patent innovative building blocks developed during the course of the project.

**ITA:** ITA has two locations, one in Zaragoza and other in Walqa (Huesca). Both of them include two remarkable buildings with the most modern facilities. Indeed, one of them has been equipped with a National Demonstrator Center, a public space to demonstrate how ICT can help to create solutions in Multimedia fields. The investment made last years was over 3 million euros in state-of the art equipment. And these equipment have been added to the previous existing laboratories improve them. These laboratories also include a usability lab which will help to create very friendly applications to be used by elderly people. The National Demonstration Center (<http://www.cdaudiovisual.es/>) will be available in the project to host a demonstrator or a pilot for testing and showing the research results of the project ant to offer further dissemination activities through different events.

**Hospital de Barbastro:** Barbastro’s Hospital, as a public Health entity, cannot exploit DemWatch results as products. Nevertheless, services that come out from the project will be deployed onto the eight other healthcare areas and therefore, they will be available to all Aragon inhabitants. Barbastro’s Hospital has also influence on the neighbour technological industries and is able to transfer the know-how to its partners.

**ARDIC:** The most powerful part of this new project is the challenge it will bring to our development group. As they’ve been doing the last 3 years; each and every new project make our company more competent more inventive and more skilful. Besides; our main goal is to be part of an international project in health. This will serve our 3 year old interest as the health sector is the second biggest sector in our target groups.

**IC Neuronic:** IC Neuronic will develop a platform for measuring the cognitive status of a person and its location. We expect to be able to sell it as product to our main customers, medical practitioners and institutions. We are also interested in using this platform to create new products in other interesting areas, like child supervision.

**VTT:** Memory disorders and dementia care are part of the Health and Wellbeing area at VTT and address a significant and expensive societal problem in Finland.

Finland features a number of SME companies in this field that VTT can help to grow to international potential. VTT is one of the few institutes that has the knowhow and networks to develop this complex technology. VTT has a strong background on human-centred design and ageing, ubiquitous computing, context awareness, and activity analysis. The project will generate unique competence on dementia and memory impairment care, as well as enhance the competence on behaviour observation and modelling. VTT will exploit this enhanced competence in its future R&D projects.

# Consortium

## Consortium overview

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| PARTNER | COUNTRY | TYPE | POSITION IN THE VALUE CHAIN |
| VTT | FI | RES | VTT brings in-depth understanding on end-user needs and requirements, values and user experience, based on life-based design methodology. This includes analysis of forms of life of people with memory disorders and their family care givers (problem definition). VTT also participates in scenario work and creation of use cases of technology for different kinds of memory support rehabilitation and support services for different stakeholders. This results in service concept design (including co-creation methods), as well as usability design and evaluation. Finally, fit-for-life analysis is carried out, with the help of which it is possible to reassure that the developed application really enhances the quality of life of users.  VTT brings knowledge of designing assistive technology at home and on the move (various reminders, support by home automation means, and support by mobile technology using e.g., location and other sensing technology), andGUI to various home services and devices, as well as **u**ser monitoring solutions: intention awareness and emphatic user interfaces. |
| University of Jyväskylä, Department of Information Technology (Cognitive Science) (JYU) | FI | UNI | JYU brings in-depth psychological and cognitive scientific understanding to the consortium. Psychology of memory forms the foundations of modern dementia research. Therefore, understanding how memory works, which are its main subsystems, how it can be rehabilitated and trained is an essential piece of knowledge in the construction of new technologies and giving them a proper form.  JYU brings also, in co-operation with VTT, on knowledge user needs and requirements, including analysis of forms of life of people with memory disorders and their family care givers (problem definition), state-of-the art of memory research and rehabilitation, and criteria for patient state analysis. JYU also takes part in the creation and analysis of scenarios and use cases of technology for different kinds of memory support rehabilitation and support services for family caregivers, service concept design, (icl. co-creation methods), usability design and evaluation and fit-for-life analysis (reassuring that the developed application really enhances the quality of life of users). |
| CEA | FR | RES | CEA Institute will be involved in the project for designing cost effective solutions for human capture activity. The solution can be implemented in both indoor and outdoor configurations with a key issue to providing accurate location information of pedestrians. This localization based approach is achieved by means of dependent infrastructure for the indoor configuration and independent-infrastructure for the outdoor configuration. In fact, we have developed over the past years several sensors localization based solutions. Among the different approaches we designed, the ultrasonic and inertial techniques may suit the requirements of the DEMWatch project.  CEA will also be involved in user needs and requirements analysis, as well as in the design of usable, useful and privacy-protecting interfaces. We will contribute to the design of reminder systems as well as focus on emotional and persuasive interfaces.  Another important contribution of CEA is on telecommunication aspects. In particular CEA will look into IPv6-based wireless sensor networking technologies (e.g. 6lowPAN over 802.15.4) for providing a flexible wireless low-power networking layer capable of supporting multiple applications on top. CEA will consider this technology both for the wireless sensor networks (WSN) deployed in the home/building as well as for wearable WSN carried by the person. |
| Telemedicine Technologies - TTSA | FR | IND | TTSA through Forthnet S.A. utilizes and integrates technological solutions on the basis of the latest telecommunications prototypes to develop and provide new services on the Network. It also utilizes various software technologies for the development of information systems for the SMEs and for the realization and provision of eServices. The approach is market-driven, aiming at:   * Delivering prototypes, experimental results and proofs of concept for application of innovative technologies into eServices and networking * Transferring know-how and facilitating the transition of production and commercial activities to modern technologies and services.   TTSA is going to contribute to the project on indoor and outdoor localization and communication, applications and integration layer especially for home sensors and the exploitation of the results. |
| Actimage | FR | SME | ACTIMAGE joins the consortium as a smartphone application development expert with graphical design and accessibility problematic skills as well as Location Based System experience. It also brings sensors network architecture experience and decision support systems based on its past and present European projects.  ACTIMAGE plays a major part in the following aspects, such as software, architecture and e-health consulting. It is also particularly interested in the data management side to complete our competence in data mining and analysis. |
| Actimage | LU | SME | ACTIMAGE joins the consortium as a smartphone application development expert with graphical design and accessibility problematic skills as well as Location Based System experience. It also brings sensors network architecture experience and decision support systems based on its past and present European projects.  ACTIMAGE plays a major part in software, architecture and e-health consulting. It is also particularly interested in the data management side to complete the competence in data mining and analysis. |
| ITA | ES | RES | ITA contributes to the **Hardware Design** and **Decision Support System** by including in the project a new indoor sensor which is not covered by the 3.1.1. This new sensor would be a camera for indoor environments, which sends information to the central system (smart) for decision making. ITA’s contribution in this part is the Smart video analysis system which recognizes risk situations based on user behavior in the video scene. This information may complement the information provided by the other sensors.  ITA has a deep knowledge in **image and video processing techniques**, scene and objects relevant features extraction, recognition and classification, pattern recognition, tracking of objects, with several R&D applications such as tele-care systems to monitor in-home incidents of elderly people, detection of user gestures to improve interaction, and detection of traffic incidences. ITA has also an intelligent artificial platform which incorporates the use of semantic analysis, Autonomic Computing, Forecasting and diagnosis, and collective intelligent in order to improve the Decision Support Systems. ITA combines these technologies with artificial vision for scene understanding by taking into account the objects features recognized.  ITA also contributes widely to the **Applications**, both user applications, enterprise applications and family or community applications.  For enterprise and community applications ITA contributes with a mobile application to have the patients geo-localized through open source GIS technologies combined with augmented reality technologies.  **Multiplatform access to the contents** by the final users is also considered an important topic for ITA, by taking into account formats compatibility, user interfaces adaptable to the platforms, and a usable access to the contents, this activity can be reinforced by the **Usability laboratory** of ITA, where usability tests can be carried out. Mobility also plays an important role when extending the tele-assistance services to outdoor scenarios or monitoring remotely the assisted dwelling by mobile services and applications. At the same time the information processed by the system can be also completed with additional synthetic information by means of augmented reality depending on the features recognized.  For user applications ITA contributes with a training application to exercise the mind of the patient based on a friendly and easy to use environment (through augmented reality, interactive TV platforms, intelligent virtual agents etc.). The idea will be to have a training program for the patient based on artificial intelligence which will take into account the context and needs of each user / patient.  Finally ITA contributes as a pilot or a demonstration in Spain with our equipment and facilities. ITA’s contribution to the value chain in the project will be research and development, production of end user and community software. |
| everis Aragón | ES | IND | everis Aragón, belonging to everis group, has a long experience in interactive television development for different platforms. For example, we have developed applications for TVE (Spanish public tv), national and regional governments, banks (like CajaMadrid, CAM, Unicaja). We are leading from this office a horizontal and international excellence center in interactive TV….. On the other hand, we are a specialized center in cross platform development among the company with important references, for example, we are currently developing an application for a national health insurance.  We have some experiences at Spanish market about integration of telecare with television and mobile environment that we will provide to the project  Taken our experience into account we will be involved at the following principal tasks:   * Analysis and definition of the requirements, the global system and the demo scenarios where we can test the result of the project. We will be leading this part within the project. * At the definition of system integration between the applications, we will be in charge of interactive tv and mobile applications. Participating at the analysis and definition of:   + **indoor and outdoor localization** and communication and leading the section of home patient devices.   + **tools and technologies for cognitive state assessment** (self-assessment, games, analysis tools) and on the other hand, Memory support applications and services. Also we will take part on games for memory assessment and training * We will be involved in integration of applications and specially leading enterprise applications at mobile and television environment * We will be involved and will provide support to the demo scenarios   Finally we will participate in the dissemination activities and exploitation plan of the project. |
| FORTEC | ES | SME | FORTEC is specialized in multi-platform deployment for eLearning contents and it will contribute to the project by working in the following packages: WP4, WP5, WP6 and WP7 |
| IC Neuronic | ES | SME | IC Neuronic has a long experience in the development of medical devices and sensors. With this experience the company will develop a suitable suite of sensors and systems which will enable the measurement of the physiological state of the patient and locate it indoor and outdoor. This information will be relayed to the system to enable its analysis.  The company will also work use their experience in the field of neurophysiology and its application to diagnostic in creating the use cases that will shape all the developments in the project. |
| Hospital de Barbastro | ES | (H) | Hospital de Barbastro has been involved in Ambient Assisted Living projects before. As being a healthcare provider it can offer the vision and requirements of its users and due to the feature of public provider it can reach all patients in the covered area creating the suitable environment for demonstrate and test potential future services.  The hospital comprises a mental health unit with professionals, neurologists and dedicated experts in the treatment of these types of pathologies, along with a wide contact network in other sanitary areas of the organization to which it belongs.  Hospital de Barbastro contributes to the project especially in solution evaluation, development of demonstrations and knowledge based decision system as well as data security and privacy issues. |
| TURKCELL | TR | IND | TURKCELL Technology focuses on applied research projects with critical importance in telecom with a particular emphasis improving its customer’s communication needs. To achieve this, **Embedded Systems Lab** develops a low-cost, highly connected communications module (TCM) with a development kit to facilitate M2M communication applications mainly for the health, patient condition tracking use cases.  TURKCELL contributes to the DEMWatch project by extending its TCM properties of small size, low power consumption, low cost and easy programmable interconnected devices in conjunction with DEMWatch sensor agents wearable for outdoor or mounted inside home for indoor locationing. Within this project, TURKCELL is going to lead the platform and architecture of DEMWatch system as well as taking part in system integration of sensors agents (Task 3.3) as well as indoor and outdoor localization and communication of these sensor agents (Task 3.4). TURKCELL is going to work on wearable devices for dementia patient both nomadic and home living depending on severity of the illness (Task 3.5).  TURKCELL is also going to work on requirements and analysis of DEMWatch system by defining use cases for the Severe Memory Disorders (Hospitalized or Home Patients), thus requirements for the dementia patients that fall into this category (Task 2.2). As system integrator, TURKCELL is going to develop integration part of the Global Architecture of whole system (Task 2.3). TURKCELL’s contribution to the value chain in the project will be research and development, production by system integration. |
| ARDIC | TR | SME | ARDIC specializes in mobile device management and cloud computing. It defines user requirements (Task 2.1), lead the Security, privacy, trust concerns and ethics works (Task 2.4), aid in system integration and indoor/ outdoor localization communication, applications and integration tasks of the project (Task 3.3, Task 5.3). ARDIC’s contribution to the value chain in the project is mainly requirements definition and system integration. |
| BOR YAZILIM | TR | SME | BOR is a valuable asset for the consortium with experience in platform development (mobile application development platform, Internet Video Management Platform), and also its experience in mobile healthcare solutions is another asset for the services that will be built up in DEMWatch. BOR’s contribution to the value chain in the project is production, producing end-user applications and demonstrators. |
| ANKIRA | TR | SME | Ankira is a systems integrator company for emergency communication systems in healthcare. Ankira mainly provides software services and equipment to hospitals. It will lead the definition of demo scenarios in this project (Task 2.5). It also contributes to DEMWatch solutions evaluations as well as the development of demonstrators, and the dissemination of project results and standardization. Ankira’s contribution to the value chain in the project is distribution of the end product. |

## Cooperation added value

As the goals of the project are focused on two distinct areas, namely i-) on early detection and training of memory functions based on serious gaming technology and ii-) on locating people and their context, the consortium competence is sufficient enough to reach these goals. Consortium is still seeking a partner whose expertise area is Energy Harvesting.

Consortium is made up of 3 large industries, 3 research institutes, 1 university, 8 SMEs and 1 Hospital from 5 different countries (ES, FI, FR, LU, TR) each participating into the DEMWatch with the following project related capabilities among their large expertise areas:

**VTT**

Forecasting future technological and market development trends, creating novel know-how, providing customers with new development impulses, developing technologies and concepts, applying technologies, and enhancing technology transfer and utilization

**CEA**

Sensors and signal processing (industrial control systems, health, security and metrology

**ITA**

Artificial Intelligence & soft computing in Media, Multimodal interface with the assisted person, User Experience, Multiplatform access to the contents by the final users, New interaction ways of Human Machine Interface (HMI), Vision Technologies and 3D sensing and novel

**JYU**

Cognitive Sciences, wellness, human and health technology; ICT in learning

**TURKCELL**

GSM operator with 37 mi. customers in the region, value added services, mobile marketing, embedded systems, infrastructure and services in health telematics

**TTSA**

Delivering prototypes, experimental results and proofs of concept for application of innovative technologies into eServices and networking

**everis Aragón**

Development of commercial multi-platform and interactive applications in different platforms such as IPTV, Windows Media Center, MHP, HbbTV and proprietary smart TV platforms, and integration of tele-care services into interactive TVs.

**ACTIMAGE**

ICT services, mobile, business, integration, infrastructure, network in technologies like J2EE, .NET, PHP/JavaScript/HTML/CSS

**FORTEC**

FORTEC bets constantly for the development of vanguard technology, with two fundamental premises: the adaptation to the usability and accessibility determinants of the addressed collective of the training and the application of standards of technological and pedagogical quality for the production of didactic digital contents.

**IC Neuronic**

Hardware and software applications related to clinical neurophysiology

**Hospital de Barbastro**

Hospital, demonstrators, dementia patients’ panel, uses cases definition

**BOR**

Mobile software solution providing, Internet video publishing systems, GIS based software solutions and enterprise E-Government solution providing

**ANKIRA**

Systems Integrator Company for emergency communication systems in healthcare

**ARDIC**

Mobile embedded operating systems and cloud platforms facilitating the utilization of new generation mobile devices. Core competencies are: Over the air updates, Full device management, User management, Application store and management.

# Work Description

**Project Management Plan:** A project management structure and reporting guidelines are going to be described in such a way that the challenges in coordination and communication are addressed in the most efficient way. In addition to the Project Leader, we are going to build a coordination committee to supervise the project management and the work package leaders. During the project we are going to establish a technical steering group and dementia specialists to review the quality of works.

**Contribution of Each Partner:**

**ACTIMAGE FR**

**WP2:** As an IT specialist Actimage will be involved in the definition of the global system architecture. The company will also take part in the demo scenario since it will develop one of them.

**WP4:** Actimage will lead the work on the serious gaming aspect of the project. It will be mainly about using augmented reality technologies the company has experience with, to make them interact with the basic DEMWatch services (localization) and portable devices to create a serious game in the whole living environment of the patient.

**WP5:** As an IT development and architecture expert, Actimage will have major role in the very technical work package, on all the data aspects. The company will focus on all the data treatment chain, i.e. collection, integration, and security/privacy aspects.

**WP6:** Being very involved in the development of the serious gaming applications, Actimage will naturally be involved in the evaluation process of this demonstrator.

**WP7:** Actimage will develop the website for the project communication. The company will of course be implied in the exploitation plan of the global solution, as well as its own following exploitation of the project results for extensive applications.

**ACTIMAGE LU**

Actimage LU is present in WP2, WP5 (TL 5.1.1, 5.3.3, 5.4.2), WP6, WP7.

**WP2:** ACTIMAGE Luxembourg will contribute to the definition of the demo scenarios. We will also contribute to the realization of the demos as the project iterates (WP6), so we will have a complete overview of the choices that will be made.

**WP5:** ACTIMAGE will be task leader on 5.1.1 data collection, an important topic nowadays in which the company will gain in expertise. Task 5.2.2 alerts and notifications systems will leverage our implication in data collection. Those tasks together with Task 5.3.4 Community Services and Social Media that are directly aiming the end users on their smartphones, the core expertise of ACTIMAGE. The technologies provided will of course be tested and evaluated in Task 5.4.

**WP7:** ACTIMAGE has expertise in dissemination activities thanks to present and former ITEA2 and AAL projects. Our expertise and knowledge of the newest technologies are growing fast as we are working in European Projects, and so does our product portfolio. New product could be launched based on our implication in this project.

**TURKCELL**

**WP1:** As the project coordinator TURKCELL will be responsible of all project management, co-ordination, and progress report and information dissemination efforts. These efforts will include in detail:

* Planning and tracking: maintaining the project plan, regularly track it and synchronize the project activities as to achieve the expected results.
* Organization or project meetings: Prepare and conduct periodic meetings of all participants on project issues.
* Status and cost reporting: Periodically report information about the project progress and costs incurred.
* Risk assessment and action taking: Regularly analyse the risks and take mitigation actions.
* Quality assurance: Ensure quality of project results planning and controlling respective activities.

TURKCELL will also employ among project partners, DDE, dementia domain experts to supervise that the project is producing the right solutions to address the actual dementia care requirements and slight memory disorders effectively. There will be also a TSC, technical steering committee, made up of technology domain experts to supervise the technological progress.

**WP2:** In this work package, TURKCELL will contribute to the definition of use cases and requirements for Intermediate Memory Disorders (Nomadic Patients), what kind of location and monitoring technology is needed at this stage, and definition of system integration.

**WP3:** Platform and Architecture is the main playground for TURKCELL in this project. We are going to contribute to the indoor/ outdoor localization and communication, lead and contribute to the system integration and wearable devices by dementia patient.

In **WP4**, we don’t envision a lot activity except the Agents and Sensors communication. We will contribute to the exploitation works in the **WP7**.

**TTSA**

**WP2:** Contribution to the definition of use cases and demo scenarios

**WP3:** TTSA, through Forthnet’s parent company extensive experience in telecommunications and data networks will be involved in the design of the overall DEMWatch network and communications’ architecture and development, followed by their integration to the proposed project’s platform.

**WP4:** TTSA will target its contribution to the memory support applications and services for the end-users of the DEMWatch platform, through a cognitive and easy-to-use interface, provided over a number of supported devices, like mobile devices and in-home appliances.

**WP5:** TTSA will be mainly involved in the development and integration of the advanced alert and notification services to the end users, with the use of instant communication methods, while also contributing in the proposed sensor data acquisition framework.

**WP7:** TTSA, through Forthnet, utilises and integrates technological solutions on the basis of the latest telecommunication prototypes, in order to develop and introduce innovative services to the market. Under this scope, mid- and long- term commercial exploitation of the DEMWatch project results as well as the exploitation of the individual software modules will be investigated.

These will derive from the technological expertise that will be gained out of the research activities of the project, integrated with the core competences and business interests of the company

**BOR**

**WP2:** Global Architecture: Bor will provide at least one software leadership in order to work on defining architecture. Security, privacy, trust concerns and ethics: Bor will work on defining authorisation, authentication and privacy issues and needs.

**WP3:** System Integration: Bor will work on integrating sub projects into system.

**WP5:** Data Security and Privacy: Bor will work on design and implementation of security components. Patient Monitoring: Bor will work on design and implementation of tracking, monitoring applications. Applications and Integration: Bor will work on implementation and design of applications on all branches. BOR will work on usability and accessibility evaluation.

**WP6:** Bor will work on the implementation and evaluation of case studies.

**WP7:** BOR will lead the work package, Dissemination: one or two of project members will also study on DemWatch at graduate level in one of the top faculties at Ankara. We will publish articles, conference papers and workshop presentations on DemWatch, Also Bor is eager to develop Web2.0 solutions for community members. Standardization: We will help on standardization case with our knowledge at dissemination and we will contribute on following ISO and IEEE standards on software development.

**CEA**

**WP2:** CEA’s LISA team will contribute to the user needs and requirements analysis, as well as in the design of usable, useful and privacy-protecting interfaces. We will contribute to the design of reminder systems as well as focus on emotional and persuasive interfaces. CEA’LISA will be involved in the following tasks:

* Problem and user requirements definition for the design of the DEMWatch system
* Technical specification and definition of the global architecture of the DEMWatch system
* Definition of strict security, privacy and ethical principles and guidelines
* Definition of a number of usage scenarios for demonstrating the potential of the DEMWatch system

CEA’s LSC research team will contribute to the definition of the requirements related to the wireless IP communications capabilities and corresponding architecture to enable the DEMWATCH user cases (task 2.3).

**WP3:** CEA’s LISA will lead the task 3.4 on indoor and outdoor localization solutions with an objective of designing cost effective solutions for human capture activity. The solution will be implemented in both indoor and outdoor configurations with a key issue to providing accurate location information of pedestrians. This localization based approach is achieved by means of dependent infrastructure for the indoor configuration and independent-infrastructure for the outdoor configuration. Among the different approaches that would be compared, the ultrasonic and inertial techniques. The most reliable and accurate indoor solution will be deployed during the DEMWatch project. The indoor solution will also be combined to GNSS for outdoor environment to provide a full reliable localization system. CEA’s LISA will also be involved in task 3.5 “wearable devices” with a significant contribution on embedding the indoor and outdoor locating system. Miniaturization of the sensors and driving electronics will be addressed to guarantee a compact wearable solution.

CEA’s LSC research team will contribute on telecommunication aspects in task 3.4 “Indoor and outdoor localization and communication”. In particular CEA will look into IPv6-based wireless sensor networking technologies (e.g. 6lowPAN over 802.15.4) for providing a flexible wireless low-power networking layer capable of supporting multiple applications on top. CEA will consider this technology both for the wireless sensor networks (WSN) deployed in the home/building as well as for wearable WSN carried by the person. In particular, CEA will address technical challenges like interworking of WSN with a global IP infrastructure, mobile WSN gateway to enable continuity of the connectivity in indoor-outdoor mobility scenarios, and streaming capabilities over low-rate low-power low-cost WSN.

**WP5:** CEA’s LISA will actively contribute to the solution evaluation task 5.4 to reach a usable, useful and privacy-protecting interface. The evaluation will be carried out for a number of usage scenarios for demonstrating the potential of the DEMWatch system. CEA’s LSC research team will contribute in task 5.3.1 “Agents/Sensors communications” through the software prototyping of the IPv6-based wireless sensor networking capabilities designed in WP3.

**WP7:** CEA will contribute to the project exploitation (7.1) and dissemination (7.2) activities.

**everis** **Aragón**

**WP1:** As coordinator of Spanish partners everis Aragón will lead the Spanish consortium with Spanish public authority and within the international consortium.

**WP 2:** everis Aragón will be the leader of this Work Package so we will be in charge to define the requirements based on the users problems, the total architecture required to commit those requirements and finally to define demo scenarios to be able to apply and test the final system to be developed.

**WP3:** everis Aragón will participate in this WP to clearly define the system integration between the applications we will be in charge of: interactive TV and mobile applications. More detailed everis Aragón will take part on the analysis and definition of indoor and outdoor localization and communication and leading the section of home patient devices.

**WP4:** everis Aragón will take part of Assisted Memory Assessment specially leading some tasks: tools and technologies for cognitive state assessment (self-assessment, games, analysis tools) and on the other hand, Memory support applications and services. Also everis Aragón will take part on games for memory assessment and training.

**WP5:** As an IT development everis Aragón will be involved at every task about applications and integrations and specially leading enterprise applications. On the other hand, we will participate in the data collection and integration. Also everis Aragón will take part on the evaluation of the solution focused on a high quality.

**WP6:** everis Aragón will be involved and will give support for the demonstration scenarios.

**WP7:** everis Aragón is implied in the exploitation plan of the global solution, as well as its own following exploitation of the project results for extensive applications. Also everis Aragón will participate in dissemination activities within the international company and among our clients.

**ITA**

**WP2**: ITA will be focused in this WP in the use cases definition of the project and the user requirements, to take them into account for the software implementation. ITA will be participating in the definition of the demonstrations scenario to test the whole system integrated in the laboratories and in a real situation with users.

**WP3:** ITA will participate in this WP to define and design a smart video analysis system which recognizes risk situations based on user behavior in the video scene based on video surveillance cameras located inside the home. This information may complement the information provided by the other sensors. We also will take part on the analysis and definition of indoor localization based on our smart video analysis system.

**WP4:** ITA will be involved in the Technology Assisted Memory Assessment and Support, mainly to use different tools and technologies for cognitive state assessment and the different application and services to the Memory support. Our idea is to introduce and test the multiplatform access to the contents, by taking into account formats compatibility, user interfaces adaptable to the platforms, etc. Finally ITA will also be involved in the task of games for memory assessment and training giving ICT support to the content developer companies.

**WP5**: ITA as a Research Institute, with a research line in artificial intelligent, media and interactive systems, has a big focus in this work package and will lead it. Concerning the Decision Support System ITA will be focused in the Decision Support System participating in the data collection and also in the alert and notification system as well as in semantic analysis, Autonomic Computing, Forecasting and diagnosis, and collective intelligent to design and develop the Decision Support System. ITA will also design and implement intelligent artificial vision-based algorithms to understand in-home patients’ scenarios automatically to detect risky situations of the patients within the End User Applications subtask. ITA will also be involved in the applications and integrations task, mainly in the enterprise, end user and family applications to offer services which enable a better care and localization of the patient and his/her environment through several interactive platforms such as interactive TV and mobility. On the other hand, ITA will participate in the solution evaluation to test and evaluate a usable access to the contents. This activity can be tested in the Usability lab of ITA where the user experience can be measured.

**WP6**: ITA will be taking part in this work package to host a demonstrator in its facilities and laboratories to test the system developed focusing in usability and accessibility of the developments for the users.

**WP7**: ITA will be involved in the dissemination activities of the project by means of the publication of articles in scientific journals and the attendance at conferences related with the AAL topic, like AAL Forum to explain and disseminate the results obtained in the project. ITA will participate in the exploitation of the project results by means of transferring the knowledge to other companies of the region and to improve the systems and the platforms developed in the project.

**IC Neuronic**

**WP2:** IC Neuronic will be the leader of task 2.1, Definition of Use Cases. Here we will identify, select and choose the most important situations that the system has to solve. With this we will be able to asses later the fitness of the solution developed in the project.

**WP3:** We will be doing every stage of the development in some of the sensors, from the concept to the prototype implementation. This will include wearable and fixed sensors including the agent supporting platform. There we will also be the leader in the task of developing systems to enable the localization of the user indoor-outdoor.

**WP5:** In this phase we will be working integrating the agent platform embedded on the sensors developed in WP3 with all the systems developed by other partners. This system will be able to notify the users in real time of the alerts and notifications that are deemed important.

**WP6:** Here we will be working in the integration of the developed systems into the Spanish demonstrator working in the interoperability with the systems of the other partners.

**WP7:** IC Neuronic will use its contacts and commercial network as a medium to introduce potentially interested prescribers to the technology developed in this project. This will allow the medical professionals to have access to the commercially available devices for enhancing his patient treatments.

**ANKIRA**

**WP2:** Ankira Ltd. will develop demonstration scenarios; execute Quality of Experience studies with medical academics and practitioners of our customer hospitals.

**WP5:** Ankira will develop test scenarios to assure results comply the requirements of the overall system. The solution that will be used by the patients should be verified to be easily usable by them. The overall performance results should be evaluated.

**WP7:** Ankira Ltd. has means to contact state hospital network online. We will work in event organisations and promotional activities of the project results in our customer hospitals. Ankira will also lead demonstration activities in the Ministry of Health.

Ankira will integrate relevant sensor devices using TURKCELL software development kit and present it as a service in hospitals. Ankira is interested in providing e-health services using industrial partners’ hardware solutions.

**VTT**

**WP2:** In this work package VTT will lead the task Problem definition and User Requirements (2.1), and lead the task of the definition of use cases and requirements for people with early stage memory disorders (2.2.1). VTT will also define the demo scenarios related to the use cases with VTT involvement (2.5) and contribute to the discussions on ethical issues (2.4).

**WP3:** VTT will participate in this WP and lead the task 3.1.1 “Wearable Body Sensors” as well as contribute to the home sensor task (3.1.2)

**WP4:** VTT is the leader of this work package and will have a major role in creating tools and methods to identify emerging memory disorders as early as possible and to provide means to support the person. VTT will contribute to all tasks and aim to develop algorithms and models for behaviour analysis and intention detection, interactive solutions to provide unobtrusive feedback, and apply serious gaming solutions for cognitive state assessment and training.

**WP5:** VTT participates in this WP to the tasks supporting the work in WP4, which is the main focus of VTT. In particular VTT will participate in data collection (5.1.1) needed for the behaviour observation in task 4,1, end user applications (5.3.3) related to early stage memory disorders, and all evaluation tasks (5.4).

**WP6:** In this work package VTT will participate in the development and evaluations of demonstrators.

**WP7:** VTT will participate in the exploitation and dissemination activities concerning the results of the project.

**University of Jyväskylä**

**WP2:** JYU brings to the consortium knowledge about how human memory works and what are the memory disorders like, their diagnostics, practical everyday problems, rehabilitation and monitoring ideas and practices. This knowledge is used in developing technology concepts and user requirements by means of life-based design. The outcome will be concept plans for modeling people and possible technologies, and the ways people are intended to use the technologies.

**WP4:** JYU collects state-of-the art information on the psychology of dementia and other memory disorders. It also reviews the current ICT-based technical tools developed for supporting memory. Moreover, it brings to the consortium knowledge about the main trends in diagnostics and treatment of memory disorders. This knowledge can be used to develop scenarios and technology concepts during the project. JYU participates to designing the human aspects of new technologies. It also tests the new practices with patients and makes suggestions about possible improvements.

**WP6:** JYU participates in the innovation of concrete uses for serious game technologies for diagnosis, monitoring and rehabilitating memory performances of people with dementia or impaired memory performance. JYU also tests the prototypes of the solutions.

**WP7:** JYU participates in the dissemination of the results concerning the design processes, methods and the actual applications from the human side.

**FORTEC**

**WP2**: FORTEC will be focused in this WP in the use cases definition of the project and the user requirements, to take them into account for the serious games design for memory disorders. FORTEC also will participate in the demonstrator scenario design.

**WP4:** FORTEC as a specialist on eLearning methodologies and technologies will be involved in this WP, mainly focused on the serious games for memory training and assessment and on the generation of contents adapted to different platforms and tools.

**WP5**: FORTEC will be taking part in this work package to develop applications for the dementia patient and families to disseminate specific content and support materials related to memory disorders. FORTEC will also be involved in the solution evaluation to test and evaluate a usable access to the contents.

**WP6**: FORTEC will be involved in this work package giving support to the rest of the partners in the demonstrator development, mainly in the tasks related to the serious gaming.

**WP7**: FORTEC will be participating in the exploitation and dissemination activities of the project by means of the publication of the results in the project in different specialist media and using this results to improve our products.

## WP Structure and overview plan

**WP Structure:**

|  |
| --- |
| **1.       Project Management** |
| 1.1. Co-ordination |
| 1.2. Progress Reporting |
| **2.       Requirements and Analysis** |
| 2.1. Problem Definition and User Requirements |
| 2.2. Definition of Use Cases |
| 2.2.1.        Early stage memory disorders (Prevention techniques) |
| 2.2.2.        Intermediate Memory Disorders (Nomadic Patients) |
| 2.3   Global Architecture |
| 2.4. Security, privacy, trust concerns and ethics |
| 2.5. Definition of demo scenarios |
| **3.       Platform and Architecture** |
| 3.1. Sensors as agents |
| 3.1.1.        Body Sensors (Wearable) |
| 3.1.2.        Home Sensors |
| 3.2. Energy Efficient Design (Energy Harvesting) |
| 3.3. System Integration |
| 3.4. Indoor and outdoor localization and communication |
| 3.5. Wearable Devices |
| 3.5.1.        Home Patient Devices |
| 3.5.2.        Nomadic Patient Devices |
| **4.       Technology Assisted Memory Assessment and Support** |
| 4.1. Behavior observation & modeling |
| 4.1.1 Collection of information sources |
| 4.1.2 Context and activity recognition |
| 4.1.3 Behavior modeling |
| 4.2 Cognitive state assessment |
| 4.2.1 Methodologies for cognitive state assessment (memory and planning capabilities) |
| 4.2.2 Cognitive state assessment from behavior and performance |
| 4.2.3 Assessment of changes in emotional states |
| 4.2.4 Tools and technologies for cognitive state assessment (self-assessment, games, analysis tools) |
| 4.3 Unobtrusive feedback and support |
| 4.3.1 Cognitive support methodologies |
| 4.3.2 Unobtrusive UI technologies for feedback provision and support |
| 4.3.2 Memory support applications and services |
| 4.4. Serious gaming |
| 4.4.1 Games for memory training |
| 4.4.2 Games for memory assessment |
| **5.       Software and System Design** |
| 5.1. Data Management |
| 5.1.1.        Data Collection |
| 5.1.2.        Data Integration |
| 5.1.3.        Data security and privacy |
| 5.2. Knowledge Based Decision Support System |
| 5.2.1.        Patient Monitoring |
| 5.2.2.        Alerts and Notifications Systems |
| 5.3. Applications and Integration |
| 5.3.1.        Agents/ Sensors communication |
| 5.3.2.        Enterprise Applications |
| 5.3.3.        End User Applications |
| 5.3.4.        Community Services and Social Media |
| 5.4. Solution Evaluation |
| 5.4.1.        Testing |
| 5.4.2.        Usability and Accessibility |
| 5.4.3. QoE Evaluation |
| **6.       Development of demonstrations** |
| 6.1. Environment-based serious gaming |
| 6.2. Evaluation of demonstration - 2 |
| **7.       Exploitation and Dissemination** |
| 7.1. Exploitation |
| 7.2. Dissemination |
| 7.3. Standardization |

### Project and Work Package Leaders information

**Project Leader:** Aylin YORULMAZ

TURKCELL

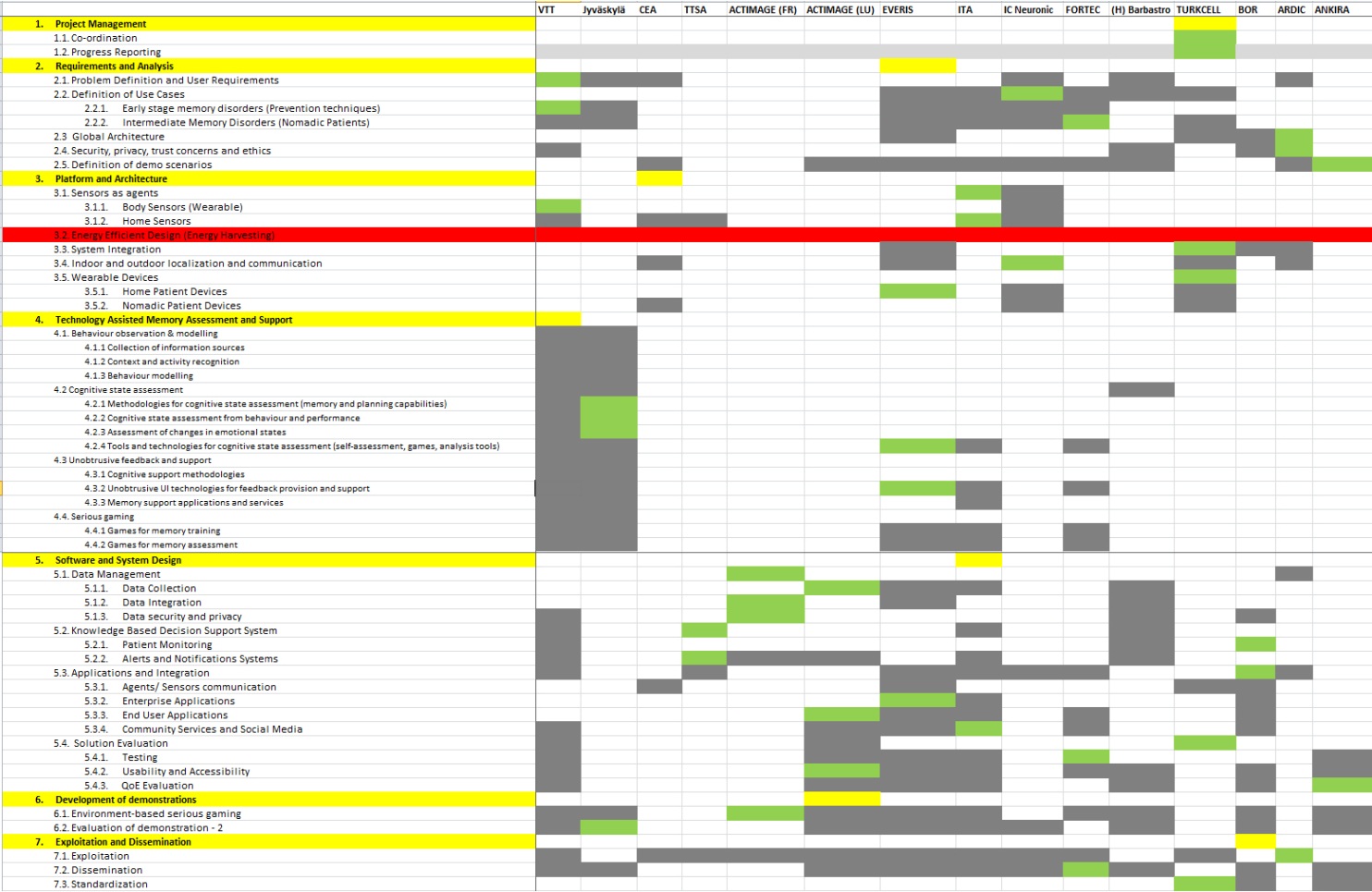
[aylin.yorulmaz@turkcellteknoloji.com.tr](mailto:aylin.yorulmaz@turkcellteknoloji.com.tr)

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|  |  |
| --- | --- |
| WORKPACKAGE | LEADER |
| **WP1** – Project Management | Aylin YORULMAZ – TURKCELL (TR)  [aylin.yorulmaz@turkcellteknoloji.com.tr](mailto:aylin.yorulmaz@turkcellteknoloji.com.tr), +90 532 2103904 |
| **WP2** – Requirements and Analysis | Elvira Narro Artigot – everis Aragón (ES)  [elvira.narro.artigot@everis.com](mailto:elvira.narro.artigot@everis.com), + 34 902 196 346 |
| **WP3** - Platform and Architecture | Christophe Janneteau – CEA (FR)  [christophe.janneteau@cea.fr](mailto:christophe.janneteau@cea.fr)**,** +33 1 69 08 91 82 |
| **WP4** - Technology Assisted Memory Assessment and Support | Arto Laikari – VTT Technical Research Center of Finland (FI)  [arto.laikari@vtt.fi](mailto:arto.laikari@vtt.fi), +358 20 722 111 |
| **WP5** - Software and System Design | Carolina Benito Lahuerta – ITA (ES)  [cbenito@ita.es](mailto:cbenito@ita.es), +34 974 012 562 |
| **WP6** - Development of demonstrations | Sandrine BOUSSONNIE – ACTIMAGE (LU)  [sandrine.boussonnie@actimage.com](mailto:sandrine.boussonnie@actimage.com), +352 27 62 15 15 43 |
| **WP7** - Exploitation and Dissemination | Ozer Aydemir – BOR Yazilim (TR)  [ozer@boryazilim.com](mailto:ozer@boryazilim.com), +90 312 2861974 |

### Effort breakdown

Below is task participation of DEMWatch partners:

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Yellow highlights denote to work packages and leaders, green denotes the task leaders, grey denotes the task participation.

Efforts distribution to work packages in PY

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| COMPANY | WP1 | WP2 | WP3 | WP4 | WP5 | WP6 | WP7 | TOTAL |
| ACTIMAGE FR | 0.45 | 0.60 | 0.0 | 2.50 | 2.80 | 1.20 | 0.80 | 8.35 |
| ACTIMAGE LU | 0.30 | 0.10 | 0.0 | 0.0 | 2.80 | 3.20 | 0.30 | 6.70 |
| ANKIRA TR | 0.0 | 0.35 | 0.0 | 0.0 | 1.00 | 0.80 | 1.40 | 3.55 |
| ARDIC TR | 0.0 | 0.60 | 2.80 | 0.0 | 1.40 | 0.0 | 0.0 | 4.80 |
| BOR TR | 0.15 | 0.50 | 0.50 | 0.0 | 1.50 | 2.35 | 4.0 | 9.0 |
| CEA FR | 0.0 | 1.67 | 7.08 | 0.0 | 1.92 | 0.0 | 0.16 | 10.83 |
| everis Aragón ES | 0.31 | 0.33 | 0.40 | 0.36 | 2.10 | 0.36 | 0.14 | 4.0 |
| FORTEC ES | 0.10 | 0.29 | 0.0 | 1.08 | 0.88 | 0.33 | 0.26 | 2.94 |
| IC NEURONIC ES | 0.10 | 0.80 | 3.0 | 0.0 | 1.0 | 0.58 | 0.20 | 5.68 |
| ITA ES | 0.10 | 0.27 | 0.50 | 0.43 | 0.99 | 0.50 | 0.30 | 3.09 |
| SALUD (Hospital Barbastro) ES | 0.14 | 0.40 | 0.0 | 0.20 | 1.22 | 4.0 | 0.18 | 6.14 |
| TTSA FR | 0.30 | 0.50 | 1.80 | 0.0 | 3.10 | 0.80 | 0.50 | 7.0 |
| TURKCELL Teknoloji TR | 2.00 | 0.25 | 1.70 | 0.0 | 2.40 | 0.0 | 0.25 | 6.60 |
| University of Jyväskylä FI | 1.50 | 2.50 | 0.0 | 0.0 | 0.0 | 1.0 | 1.10 | 6.10 |
| VTT FI | 0.0 | 2.50 | 1.0 | 2.90 | 1.0 | 1.0 | 0.60 | 9.0 |

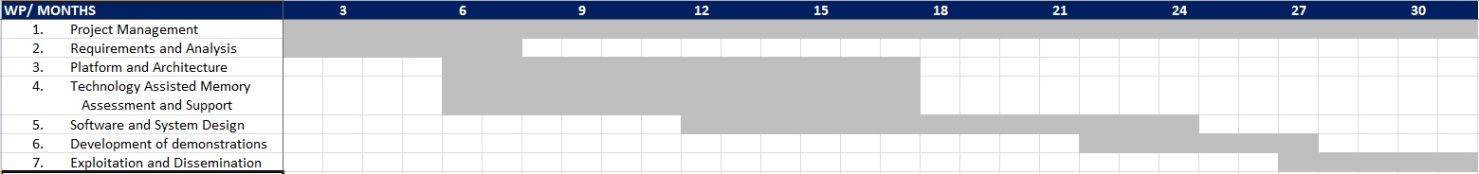
Costs and Efforts:

|  |  |  |
| --- | --- | --- |
| COMPANY | Costs (k€) | Efforts (PY) |
| ACTIMAGE FR | 668 | 8.4 |
| ACTIMAGE LU | 468 | 6.7 |
| ANKIRA TR | 187 | 3.6 |
| ARDIC TR | 346 | 4.8 |
| BOR TR | 378 | 9.0 |
| CEA FR | 1,719 | 10.8 |
| everis Aragón ES | 367 | 4.0 |
| FORTEC ES | 190 | 2.9 |
| IC NEURONIC ES | 274 | 5.68 |
| ITA ES | 296 | 3.09 |
| SALUD (Hospital Barbastro) ES | 222 | 6.1 |
| TTSA FR | 588 | 7.0 |
| TURKCELL Teknoloji TR | 341 | 6.6 |
| University of Jyväskylä FI | 583 | 6.1 |
| VTT FI | 1,350 | 9.0 |

## Work Packages description

|  |  |
| --- | --- |
| WORKPACKAGE | DESCRIPTION |
| 1. Project Management | WP1 is concerned with the overall management of the project. The project coordination will include managing the consortium on the double national and international dimensions, directing the work in the work packages (WP leaders), keeping the schedule of the project, initiating project meetings, keeping the ITEA office informed of the project progress and change requests. For efficient communication between partners and for ITEA office, a project web site will be set up and maintained with the project deliverables and progress information updates.  A technical steering committee (TSC) is going to be built and be responsible for the technical and scientific co-ordination for the day-to-day management of the work and for the closest collaboration at the tasks level. It is also responsible for collecting inputs from the partners and preparing the regular work package reports. To achieve maximum synergy, the cooperation between work packages will be monitored carefully through regular TSC screenings. |
| 1. Requirements and Analysis | The general objectives of WP2 are the following:   * Appropriate and timely involvement of users and domain experts in the overall project work * Problem and user requirements definition for the design of the DEMWatch system * Technical specification and definition of the global architecture of the DEMWatch system * Definition of strict security, privacy and ethical principles and guidelines * Definition of a number of usage scenarios for demonstrating the potential of the DEMWatch system   The WP is led by everis Aragón with the active participation of VTT and Jyväskylä University as far as user involvement, user requirements analysis and problem definition is concerned. VTT and Jyväskylä University, together with CEA, will also work on the definition of security, privacy and ethical guidelines. The technical partners (CEA, everis Aragón, ITA, IC Neuronic, FORTEC, TURKCELL, BOR, ARDIC and ANKIRA) will contribute to the definition of the technical requirements and constraints of the system, as well as to the technical specifications and the definition of its global architecture. Together, the partners with technical and user-related competences will work on the definition of the usage scenarios for demonstrating the potential of the DEMWatch system. |
| 1. Platform and Architecture | This work package will focus on the platform development and its architecture. The platform will consist of “body sensors” to monitor breathing, heart rate, sweating, skin temperature and accelerations. Theses sensors embedded on wearable devices by the patient will be fused to data captured by fixed sensors defined as “Home sensors”. These sensors could be for example bed and chair occupancy sensors, movement and fall detectors, IR beams that surround a safe area, CO and natural gas detectors, smoke detectors, and heat detectors. One major concern that will be addressed in this work package is energy efficient designs to guarantee highly autonomous devices. Energy harvesters will be investigated to provide a very small amount of power for low-energy electronics. Another critical issue that will be covered in this work package is to permanently be able to localize the patient anywhere. Indoor and outdoor localization solutions with an objective of designing cost effective solutions for human capture activity will be addressed. The localization approach proposed here is achieved by means of dependent infrastructure for the indoor configuration and independent-infrastructure for the outdoor configuration. Among the different approaches that would be compared, the ultrasonic and inertial techniques which are compact solutions embedded on the wearable device. The most reliable and accurate indoor solution will be the deployed during the project. This solution will also be combined to GNSS for outdoor environment to provide a full reliable localization system. Finally, the design of the DEMWatch network and telecommunication architecture to meet the technical requirements identified in WP2 will be addressed. In particular the proposed solution will exploit existing relevant telecommunication standards whenever possible (e.g. 6LowPAN/802.15.4) and extend them with novel technologies to address the specificities of the DEMWatch use-cases. The communication solution should also enable low-power, cost-effective and efficient wireless sensor networking for both indoor and outdoor environments, seamless mobility between indoor and outdoor, and easy integration between wearable sensor networks and external communications infrastructures. |
| 1. Technology Assisted Memory Assessment and Support | The focus of this work package is on technology assisted memory assessments and support especially for the early memory disorders states to create tools and methods to identify emerging memory disorders as early as possible and to provide means to support the person.  First we will define means to collect information, which can be used to identify contexts and various activities of a person to create models for his/her behaviour. Using the created behaviour models, we can on the next stage create tools and methods for cognitive state assessments and analysis, which can be performed either via self-assessment or by the health professionals. Next step is to offer feedback and support for the person, who has been diagnosed to have a memory disorder. This will be done with unobtrusive UI technologies for feedback provision and support as well as memory support applications and services. The assistive technology for people with slight to severe memory disorders, and the applications for autonomous memory exercise as well as controlled rehabilitation will be based on a thorough understanding of the earlier mentioned cognitive processes involved, analysis of the living situation and forms of life of the person, and capturing and modelling of the user's behaviour. The innovation lies in the ability of the solutions to take the user's life situation into account, observe and adapt to the behaviour, and apply serious gaming techniques.  In this task, we will define and develop serious game elements and building blocks for game developers to be used in several ways. Games will be used in the cognitive state assessment both by the individual via self-assessment, but also by the professionals to identify the persons “memory condition” offering additional ways for diagnoses. Games will also be used for training in the case of found emerging disorders in order to slow down the process of memory disorders. As the third track, supported by smart home technology, game elements will be used to assist everyday situations using gamification mechanisms towards the encouragement, motivation and comfort of individual."  Work package will be using the results of the WP2 and WP3 and providing output to work packages 5 and 6.  The outcome of the work package is expected to produce new applications that allow for long-term assistive solutions with an unprecedented awareness of the user's needs and intentions, and rehabilitation solutions which are both efficient and fun to use and adaptable for the needs of people with slight to severe memory disorders. |
| 1. Software and System Design | This WP will focus on the definition and development of solutions for the whole system based on the User Requirements and the Uses Cases defined previously in WP2 and in the Architecture defined in WP3. The objectives of this work package are:   * To define how the system is going to manage the data recollected from the patient: location information, health information, environment information, etc., how to integrate all this information in a Data Base and how to maintain the privacy and data security of each patient. * To design and develop an Intelligent Decision Support System, which will give smart responses to certain patient situations and help familiar and assistants to deal with them. The system will perform the patient monitoring, through pattern behavior recognition and will manage the patient risk situations that may arise. Finally the system will generate alarms, notifications and alerts to the patient user or/and to a professional monitoring center with the use of instant communication tools and through multiplatform access. * To design, develop and integrate several applications and services through different interactive platforms for the user, family, assistants, etc. This work package will perform a communication among agents and sensors and develop different sustainable and robust solutions on Dementia related applications. These applications will be oriented to different possible users: Enterprises, Dementia patients, Family, Assistants, and Friends etc. * To design and implement intelligent vision-based algorithms to understand in-home scenarios to detect risky situations of patients. * To perform an evaluation of the solution designed in this WP, focusing in the user, evaluating the quality of the user experience, the usability and accessibility of the system.   ITA will lead this WP which will be focused on the development of services and applications oriented to different possible users: Enterprises, Dementia patients, Family, Assistants, Friends etc. with the goal of offering innovative ways on Dementia related applications such as detections of risky situations, alarm generation as well as monitoring and care applications.  One of the goals is the intelligent decision support system. The aim of the smart decision support system is to collect data about the users' behavior, integrate data from different sources and take medical information will be used to generate intelligent alarms and help/recommendation to familiar and assistants In addition to meaningful integration of data from multiple sources, exposing structured data within a common framework of ontologies enables new technologies for distributed queries, data integration and ontology reasoning. The intelligent decision support system defined in this WP will use new technologies based in natural language processing, text mining, reasoning in uncertain environments, and will deploy Soft computing techniques in order to look for simple solution or more biological solution.  By means of intelligent vision based algorithms, which combining artificial vision features extraction and Artificial Intelligence and reasoning enable the detection of relevant features within the patient home to detect risky situations by taking into account the patient movements and actions.  This WP will be also focused on the development of different applications for Dementia patients, family, assistants, friends, etc. through different technologies and platforms: Enterprise Web2.0 solutions, GIS Systems, Risk situation detection and Alarms, Location, eLearning and Video applications, based on GIS, interactive applications on different devices (Tvi, mobile, tablets, entertainment devices etc.), video storage and publishing, Web2.0 portals, community and social networks etc.  Finally in this Work Package the usability, accessibility and user experience will be an essential issue, so that the entire system will be tested and evaluated using usability and accessibility methods, like focus groups, eye and body tracking, etc. This work package will develop a User-Centered Design system taking into account the user context and patient degree of dementia. |
| 1. Development of demonstrations | This Work Package is responsible for the creation of the project demonstrators, integrating components provided by Work Package 2, 3, 4 and 5 into a form which serves the business models outlined in the use-cases. The demonstrators will be, along with the deliverables, the main output of the project.  Specific and detailed demonstration scenarios will be provided and thus enrich the architecture and specifications of the demonstrators. The main outcome of the work package will be to deliver the actual demonstrators for review purposes. Demonstrators will also be shown at dissemination events where interested people will actually test and use the technologies the consortium has built. Developing the demonstrators is an important activity in order to implement ideas and concepts and collaborate together in a highly visible form. As the vast majority of partners will provide an input in the demonstration process, they will acquire knowledge and expertise in the related field.  Each demonstrator will be managed by one leading partner and, when necessary, the demonstrator will be divided into facets. Efforts will be made to ensure that technology suppliers are involved in multiple demonstrators in order for them to acquire knowledge of the complete architecture and implement it.  When the demonstrators will be ready, they will be tested in a field trial with a number of elderly people with dementia or early memory disorders. |
| 1. Exploitation and Dissemination | This work package ensures dissemination and exploitation of the project results. Almost each consortium member entities consists of R&D department which is  perfectly positioned to disseminate the knowledge acquired in the project in tutorials, publications, workshops for public and private organisations, and conferences.  The SME’s and industrial companies in the consortium will share project results with their customers  (e.g., in their marketing efforts), suppliers, and partners.  Planned dissemination activities:   * Public social network of the project for both community of developers and community of dementia effected people (patients or their relatives) * Participation in fairs and meetings especially suited for dissemination of project results to SME’s. * Publications and participation at major health & medical conferences and exhibitions relevant to the project’s topic. |

**Roughly Time Based Work Plan:**

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# Rationale for public funding

In its essence, DEMWatch is a project designed and dedicated to a major societal and health issue. The care of people suffering from memory disorders currently needs more resources, which are, however, not expected to increase as fast as the number of people in need of care. The problems that the social- and health care sector faces are for example the following:

* Increasing cost for health insurance;
* Inappropriate home care resulting in heavy burden for the family care givers;
* Exhaustion and burn-out syndrome of the specialized personnel,
* Lack of rooms in dedicated institutions;
* Loss of efficiency; an increasing number of patients are provided only with physiological health assistance and medication in a hospital or an elderly care center;

This is due to the growing population suffering from this disorder, that in the end needs permanent assistance and monitoring, with mind stimulation to help fighting the spread of the disease. There are currently few tools to enhance efficiency of care on this field, that has been researched since quite recently only. Thus, there is a need for technological improvement helping the whole caring chain, from the family to the health insurances, including of course the patients. This is how we can make the difference between treating dementia as a state of near-death, and slowing it down while giving more autonomy to the patients.

As exposed earlier in the project, this affection concerns today more than 35 million people worldwide, and more than 65 million by the end of the decade. Everyone can be concerned. Thus, developing technologies to improve the care and assist the patients’ needs to be a large societal project.

The hardware starting point of the project enables new opportunities for dementia patients, with a much better potential of acceptability. Thus, it will be possible to explore completely new brain activity stimulation such as bringing the concept of serious gaming to the whole environment of the person, creating activities that help keeping autonomy and stimulate activity while being monitored, all at the same time. There are several actors needed to develop this while chains, dealing with the hardware issues, data interpretation, making innovative applications for each different kind of patient and degree of dementia, test it with medical advices, etc. The DEMWatch consortium has the required expertise brought by very different entities to produce rich and various ideas and points of views.

In a nutshell, DEMWatch perfectly fits the requirements for public funding because:

* It addresses a major societal health issue that everyone may be concerned about
* It brings a new hardware and software approach of the care of memory disorders and dementia
* It involves a wide and strong consortium that will ensure deep research on all concerned fields, and wide dissemination at every level of the value chain and Europe-wide.

# Contacts with Public Authorities

|  |  |
| --- | --- |
| FINLAND | |
| **Consortium national contact person** | **Public Authority contacted person** |
| Jaana Leikas  VTT Technical Research Centre of Finland  [jaana.leikas@vtt.fi](mailto:jaana.leikas@vtt.fi)  +358 20 722 3385 | Olavi Keränen  TEKES - The Finnish Funding Agency for Technology and Innovation  [etunimi.sukunimi@tekes.fi](mailto:etunimi.sukunimi@tekes.fi)  +358 9 694 9196 |
| Type of Funding: **Grant**  TEKES will be contacted in the FPP phase. The Finnish consortium will be extended with Finnish companies to balance the national consortium. | |

|  |  |
| --- | --- |
| FRANCE | |
| **Consortium national contact person** | **Public Authority contacted person** |
| Mehdi Boukallel  CEA List  [mehdi.boukallel@cea.fr](mailto:mehdi.boukallel@cea.fr)  +33 1 46 54 70 82 | Franck Tarrier  DGCIS  [Franck.tarrier@finances.gouv.fr](mailto:Franck.tarrier@finances.gouv.fr)  +33 1 53 44 96 88 |
| Type of Funding: **Grant**, Effective Funding Start Date: After the notification of acceptance from Europe funding | |

|  |  |
| --- | --- |
| LUXEMBOURG | |
| **Consortium national contact person** | **Public Authority contacted person** |
| Sandrine Boussonnie  ACTIMAGE Luxembourg  [Sandrine.boussonnie@actimage.com](mailto:Sandrine.boussonnie@actimage.com)  + 352 27 62 15 15 43 | Marc Ferring  Luxinnovation  [Marc.ferring@luxinnovation.lu](mailto:Marc.ferring@luxinnovation.lu)  +352 43 62 63 1 |
| Type of Funding: **Grant**, Effective Funding Start Date: After the signature of every national funding contract  Email and phone call exchanges with Luxinnovation. There are no specific rules for Luxembourg. Private companies are eligible to get funding; public entities are not | |

|  |  |
| --- | --- |
| SPAIN | |
| **Consortium national contact person** | **Public Authority contacted person** |
| Elvira Narro Artigot  everis Aragón [elvira.narro.artigot@everis.com](mailto:elvira.narro.artigot@everis.com)  Tel.:  + 34 902 196 346  Móvil: 616 479 827 | EMILIO IGLESIAS  Centre for the Development of Industrial Technology (CDTI)  [eureka@cdti.es](mailto:eureka@cdti.es) |
| * Presentation of the project and of the Spanish participants, by everis Aragón * General indications for ITEA2, by CDTI * Presentation of the different CDTI funds available for the Project, by CDTI * Indication of other institutional funds, by CDTI   Type of Funding: **Grant & Loan**, Effective Funding Start Date: After the signature of every national funding contract | |

|  |  |
| --- | --- |
| TURKEY | |
| **Consortium national contact person** | **Public Authority contacted person** |
| Aylin Yorulmaz  TURKCELL Technology ARGE A.S  [aylin.yorulmaz@turkcellteknoloji.com.tr](mailto:aylin.yorulmaz@turkcellteknoloji.com.tr)  +90 532 2103904 | Betül MACİT  TUBITAK – The Scientific and Technological Research Council of Turkey  [ncpsme@tubitak.gov.tr](mailto:ncpsme@tubitak.gov.tr)  +90 312 4685300 |
| Type of Funding: **Grant**, Effective Funding Start Date: 1st day of the month of application (Effective even if funding contract is signed after this date). Feedback from PA: State-of-the art, relation to other projects and rationale for funding mark the importance of the project for Turkey. | |

# Appendices

## Partners information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **COUNTRY** | **COMPANY** | **TYPE** | **PARTNER** | **EXPERTISE** |
|  |  |  |  |  |
| Finland | VTT - Technical Research  Center of Finland | RES | [Dr. Jaana Leikas](mailto:jaana.leikas@vtt.fi) | Active Aging and Technology, User Experience, Life-Based Design and Co-Creation methodologies |
|  |  |  | [Arto Laikari](mailto:arto.laikari@vtt.fi) | Software Intensive Systems |
|  |  |  | [Reijo Savola](mailto:reijo.savola@vtt.fi) | Information Security |
|  |  |  | [Julia Kantorovitch](mailto:Julia.Kantorovitch@vtt.fi) | Software Intensive Systems |
|  |  |  | [Dr. Tuomo Tuikka](mailto:tuomo.tuikka@vtt.fi) | Context Awareness, Wireless Charging |
|  | University of Jyväskylä | UNI | [Prof. Pertti Saariluoma](mailto:ps@jyu.fi) | Cognitive Science |
|  |  |  |  |  |
| France | CEA | RES | [Christophe Janneteau](mailto:Christophe.Janneteau@cea.fr) | Telecommunication, wireless sensor networking technologies |
|  |  |  | [Mehdi Boukallel](mailto:mehdi.boukallel@cea.fr) | Indoor localization systems |
|  |  |  | [Moustapha Hafez](mailto:moustapha.hafez@cea.fr) | Sensors and Man Machine Interfaces |
|  |  |  | [Sylvie Lamy](mailto:Sylvie.Lamy@cea.fr) | Inertial sensing and map matching |
|  |  |  | [Margarita Anastassova](mailto:Margarita.Anastassova@cea.fr) | User requirements, design of usable, useful and privacy-protecting interfaces |
|  | Telemedicine Technologies | IND | [Stelios Louloudakis](mailto:slou@forthnetgroup.gr) | Alert & Notification system, networks, medical data acquisition, mobile applications |
|  |  |  | [Manolis Stratakis](mailto:stratakis@forthnetgroup.gr) |  |
|  | Actimage | SME | [Selim Miled](mailto:selim.miled@actimage.com) |  |
|  |  |  | [Dina Wassif](mailto:dina.wassif@actimage.com) |  |
|  |  |  |  |  |
| Luxemburg | Actimage | SME | [Sandrine Boussonnie](mailto:sandrine.boussonnie@actimage.com) |  |
|  |  |  |  |  |
| Spain | ITA | RES | [Carolina Benito Lahuerta](mailto:cbenito@ita.es) |  |
|  | everis Aragón | IND | [Elvira Narro](mailto:elvira.narro.artigot@everis.com) | Development of commercial multi-platform and interactive applications |
|  | Fortec | SME | [Angel Esteban](mailto:aesteban@formacionytecnologia.com) | multi-platform deployment for eLearning contents |
|  | IC Neuronic | SME | [Marcos Rubio](mailto:marcos.rubio@inycom.es) | hardware and software applications related to clinical neurophysiology |
|  | Hospital de Barbastro | (H) | [Juan Coll](mailto:jcoll@salud.aragon.es)  [Rosana Angles](mailto:ranglesb@salud.aragon.es) | demonstrators, dementia patients panel, uses cases definition |
|  |  |  |  |  |
| Turkey | TURKCELL Technology | IND | [Mehmet Ozgul](mailto:mehmet.ozgul@turkcellteknoloji.com.tr) | Embedded Systems |
|  |  |  | [Aylin Yorulmaz](mailto:aylin.yorulmaz@turkcellteknoloji.com.tr) | Software Intensive Systems and Project Management |
|  | BOR | SME | [Ozer Aydemir](mailto:ozer@boryazilim.com) | Embedded Systems |
|  | ARDIC | SME | [Elif Cakmak](mailto:Elif.Cakmak@arditech.com) |  |
|  |  |  | [Haluk Tufekci](mailto:Haluk.Tufekci@arditech.com) |  |
|  | ANKIRA | SME | [Ferhat Akcin](mailto:ferhat@callvision.com.tr) | Emergency Communication Systems in Healthcare |

## Partners description

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| FINLAND | | |
| VTT Technical Research Centre of Finland | RES | VTT Technical Research Centre of Finland is a government organization established by law and operating under the auspices of the Finnish Ministry of Employment and the Economy. VTT operates under the public mandate established for it by The Technical Research Centre of Finland Act (953/2010).  VTT’s mission is to produce research services that enhance the international competitiveness of companies, society and other customers at the most important stages of their innovation process, and thereby creates the prerequisites for growth, employment and well-being.  VTT is a multi-technological contract research organization providing high-end technology solutions and innovation services. From its wide knowledge base, VTT can combine different technologies, create new innovations and a wide range of world-class technologies and applied research services, thus improving its clients’ competitiveness and competence. Through its international scientific and technology networks, VTT can produce information, upgrade technology knowledge, and create business intelligence and value added for its stakeholders.  VTT operates in VTT Group structure starting January 1, 2010. VTT Group consists of VTT research and development, business solutions, strategic research, IP business and group services. Additionally VTT manages three state owned companies: VTT Expert Services Ltd, VTT International Ltd and VTT Ventures Ltd. Together VTT and these companies form VTT Group.  VTT is serving the following customer sectors: Biotechnology, pharmaceutical and food industries, Electronics, Energy, ICT, Process industry and environment, Pulp & paper, Machines and vehicles, Real estate and construction, Services and logistics.  VTT’s key technology fields include: Applied materials, Bio- and chemical processes, Energy, ICT Industrial systems, Micro-technologies and electronics, Services and the built environment, and Business and Innovation Research.  In order to allow VTT to carry out the high-risk strategic research necessary to generate the knowledge and know-how required for fulfilling its public mandate, it receives substantial funding directly from the Finnish government. This funding amounts to approximately one third of VTT’s total income. By virtue of its status as a government organization, its public mandate, its substantial research programmes with dedicated public funding, VTT Group is the largest public applied research activity in Finland with a staff of 2900 and turnover 280 M€ .  In the past 20 years, VTT has participated in more than 1000 European R&D Framework Programme projects, within various thematic programmes. |
| University of Jyväskylä (JYU) | UNI | The University of Jyväskylä is a nationally and internationally significant research university that focuses on human and natural sciences.  The University is Finland’s leading expert in education, teacher education, adult education, as well as the largest exporter of education. Moreover, it is the only provider of sports and health sciences education in the country. Nationally speaking, the University of Jyväskylä recruits a geographically more heterogeneous student cohort than any other Finnish university.  The University operates in a multidisciplinary manner throughout the entire human life cycle and the innovation ecosystem. The technology profile of the University includes accelerator‐based technology, nano and paper manufacturing technology, ICT; wellness, sports and health technology; ICT in learning, and music technology.  The core fields are:   * Basic natural phenomena and the structure of matter * Education, learning, and teaching in the future * Languages, culture, and social change processes * Physical activity and well-being Human technology |

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| FRANCE | | |
| CEA | RES | The CEA LIST Institute focuses its research activities on developing innovative technologies for smart and complex systems.  Its R&D programs, with potentially major economic and social implications, center on interactive systems (ambient intelligence), embedded systems (architecture, software and systems engineering), sensors and signal processing (industrial control systems, health, security and metrology). Dedicated to technological research, CEA LIST’s more than 700 researchers and technicians strive to encourage innovation and technology transfer through long-term industrial partnerships. The dynamism of the Institute's teams, their project-based culture and their consistently high standard of scientific excellence underpin this objective. |
| Telemedicine Technologies | IND | TELEMEDICINE TECHNOLOGIES S.A.S. (TTSA) is a software engineering company specialized in the health sector.  The purpose of the company is:   * The design, development, production, and marketing of services and supplies related to the acquisition, transmission and retrieval of information, including electronically in the field of health; * Manufacturing, marketing, development, design and deployment of systems and services including fixed and mobile telecommunications devices and biomedical health services, computer products and services to support their use, as well as radio transmission products and related support services; |
| Actimage | SME | ACTIMAGE is an ICT Consulting company which provides ICT services to clients based in France, Germany and Luxembourg. It is also active on European Innovative Projects, especially eHealth and Smart Home.  It provides all kind of IT development: mobile, business, integration, infrastructure, network in technologies like J2EE, .NET, PHP/JavaScript/HTML/CSS. |

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| LUXEMBOURG | | |
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| SPAIN | | |
| ITA | RES | Aragon Technological Institute (ITA), is a research center from Spain. The Interactive Networked Multimedia Technologies Research group of ITA specializes in the research, development and promotion of networked technologies and audio-visual interactive multimedia services. It has a broad experience in the application of new technologies to tele-care and tele-assistance, and is interested in exploring new ways of interaction in order to provide more usable applications for the assisted person. It has experience related to the following technologies: related to Artificial Intelligence & soft computing in Media, Multimodal interface with the assisted person, User Experience, Multiplatform access to the contents by the final users, New interaction ways of Human Machine Interface (HMI), Vision Technologies and 3D sensing and novel applications. |
| everis Aragón | IND | everis is a multinational consulting firm that offers its clients comprehensive business solutions covering all aspects of the value chain, from business strategy through to systems implementation. It is active in the sectors of Banking, Healthcare, Industry, Insurance, Media, Public Sector, Telecom and Utilities. everis was established in Spain in 1996 as DMR Consulting, its name until October 2006. It started operating in Spain with the opening of an office in Madrid and Barcelona soon followed by expansion in Europe and America.  On October 2006, coinciding with everis’ 10th anniversary, the company changed its name and corporate image. A new phase begun in which the expansion of the differential consulting model, that has been the basis for its success, continues.  At present, the company has offices in Madrid, Barcelona, Seville, Valencia, La Coruña, Zaragoza, Lisbon, Milan, Rome, London, Santiago de Chile, Buenos Aires, Mexico City, Sao Paulo, Rio de Janeiro and Bogotá. Currently, everis has over 7,000 employees and its annual turnover is 410 Million Euros  everis Aragón, part of everis Group, has important experiences in developing of interactive TV applications in different platforms (IPTV, Windows Media Center, MHP, HbbTV, and proprietary smart TV platforms).  Some time ago, everis Aragón started to investigate how to integrate tele-care services using TV environment because we think that television is an easy-to-use interface for elderly people or chronic patient. There is another advantage: the end-user is used to it and the risk of rejection is minor or requires low formation. With this investment we could grow up a system using MHP standard that has been abandoned in Europe but nowadays is obsolete, we need to renew and brings more functional and standard.  On the other hand, everis Aragón is a reference among the international company in native mobile development using multiplatform frameworks. The applications to be developed can be uploaded to the apple store, the android market, the blackberry application world and the windows phone place market or as enterprise applications using some Mobile Device Management platforms.  As another reference, we have great knowledge on Mobile Device Management (MDM) as in-house distribution of applications (mobileiron, afaria) that can be used by companies to control devices and installed applications. |
| FORTEC | SME | FORTEC is a company whose basic objective is the creation and development of innovating projects that have a profitable impact on the society, paying special attention to all the processes and systems related to the training.  FORTEC is a company in the vanguard of the new technologies applied to the training, as much as in their processes of detection of needs, management, teaching or production of contents, as in the advising and development of Plans of implantation of virtual Schools or Universities for Universities or Companies.  The permanent vocation for innovation and technology, as well as the experience and qualification of the multidisciplinary team of professionals, who are part of the company, assures the provision of benefit efficient and differential services, whose last horizon is the quality and the direction to the client.  At present time FORTEC is a national reference in the scope of e-learning, annually receiving the recognition of public organism like the Tripartite Foundation for Employment Training, the autonomic services for employment or the Ministry of Industry, Tourism and Commerce, through the confidence that they place in us for the development of projects and researches.  FORTEC is articulated in four departments: E-learning Consultancy, Training Plans, Social Research and Technological Innovation.  FORTEC is an organism Q-FOR certificated, European certification of specific quality of the organisms of training and consultancy.  Moreover, FORTEC is an approved center by the European Computer Driving License for the European Accreditation of Handling of Computer, title that grants the recognition of owning a basic and complete training in computer as a user level. |
| IC Neuronic | SME | IC Neuronic SL was founded in 1994. It's a company created with the purpose of development, manufacture and commercialization of advanced medical devices. It has been developing mainly products in the area of clinical neurophysiology. These devices are used in more than 20 countries all over the world by neurologists, neurosurgeons, psychiatrists, intensive care units and other professionals researching in the field of neurosciences  The company has experience working in collaborative projects, having earned in 2001 the Iberoeka award of Technical Innovation. |
| Hospital de Barbasto | (H) | Hospital de Barbasto is included on a bigger organization called SALUD which is the health provider for Aragon. The SALUD is divided into 8 sanitary areas, one of which is Barbastro’s.  Barbastro’s Healthcare Area is the public provider of sanitary services in Primary and Specialized care, socio sanitary, and mental health assistance in the western area of Huesca province, in Aragon, Spain. We provide assistance on an 8.500km2 area and a population of 110.000 habitants, having a high rate of elders (23%)  Barbastro’s Hospital has introduced innovation on the professionals’ regular practice through the integration of telemedicine solutions thanks to the collaboration on several strategic projects. Core fields are:   * Telemedicine innovation as tele advice, tele consultations and tele monitoring of chronic elder patients * Prevention and promotion of healthcare practices * Security of patients * E-learning programs * Use of expert tools as support in the decision-making |

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| TURKEY | | |
| TURKCELL | IND | TURKCELL Technology was founded as an IT subsidiary of TURKCELL in 2007, a global GSM communications company and the only NYSE-listed company in Turkey.  TURKCELL develops services and products in Customer Relationship and Channel Management, Mobile Marketing, Business Intelligence Solutions, SIM Asset and Services Management, Roaming Solutions, Value Added Services, Operation and Business Support Systems.  Embedded Systems Lab develops a low-cost, platform independent, highly connected communications module with a development kit to facilitate M2M communication applications in the following areas:   * Health: Patient condition tracking * Energy: Smart Grids, Home and Industrial Automation * Logistics: Intelligent Shipment Tracking * Automotive: Remote vehicle diagnostics and sensor peripherals. Parking space (IS-Park) monitoring. CAN bus integration. * Agricultural automation |
| BOR | SME | BOR software has four different areas of expertise. Those areas are mobile software solution providing, Internet video publishing systems, GIS based software solutions and enterprise E-Government solution providing. BOR has finished about a dozen of projects related to those areas both at domestic and global market since its establishment at 2007.  BOR Software has been working on R&D projects funded by various Turkish ministries. BOR has finished an R&D project named on Mobile Application Development Platform, and has been dealing with another one named “Content Based Internet Video Management Platform” which will be ready at June 2012.  Even though BOR is a small enterprise; working on R&D projects is a mandatory duty according to its establishment agreement and BOR has been dedicating at least %50 of our human resource to R&D projects for five years. |
| ARDIC | SME | ARDIC (Applied Research Development and Innovation Centre) was established as a research and development company in TUBITAK Technology Free Zone in 2008. Founded by senior technologists with extensive global experience in telecom, software and ICT. ARDIC specializes in mobile device management and cloud computing. ARDIC developed its own leading-edge platforms that enable the complete independence in developing innovative applications and services; mobile embedded operating systems and cloud platforms facilitating the utilization of new generation mobile devices. Core competencies are: Over the air updates, Full device management, User management, Application store and management. |
| ANKIRA | SME | Ankira is a systems integrator company for emergency communication systems in healthcare. Ankira mainly provides software services needed for integration of various technologies and equipment to provide a complete and customized solution for a hospital. Ankira has the ability to market customized medical and telecom products to be used in health sector and hospitals. Ankira has marketing experience of DECT, GSM, in-house paging, nurse-call, emergency call, IP-PBX, nurse call, patient monitoring equipment. Ankira shaped the emergency communication specifications and regulations for hospitals in Turkey. Ankira dominated the Emergency Call Systems market in Turkey with a more than % 50 market shares in the last 5 years with a nationwide known brand name - Callvision®. |