1 Publishable Summary KSERA

1.1 Summary of project objectives

The overall objective of the project is to improve daily life of older people and people affected by Chronic Obstructive Pulmonary disease (COPD) and to facilitate their daily activities within their own domestic environment.

The specific objective of the project (project purpose) is to design a robot machine (Nao) and a smart home that measure and detect normal and anomalous living patterns of older people and people affected by COPD. The robot will interact with a target person in his/her own domestic environment, will transmit data that permit to detect possible anomalies at a very early stage and will suggest actions to the target person to improve his/her conditions.

The project is particularly relevant for the socio-economic needs of all modern societies, especially in light of the following:

- Older people want to live independently in their own homes as long as possible, and the ratio between older people (aged 65 or more) and active working population is expected to drop from 1:5 in 2000 to 1:2 in 2050.
- Chronic Obstructive Pulmonary disease (COPD) is expected to be the 3rd leading cause of death in 2030 increasing the annual EU health care cost to €7.6 billion.
- Age-related diseases such as COPD cause a decline of the patients' capabilities, including mobility limitations and self-care restrictions.

1.2 Description of the work performed since the beginning of the project and main results achieved so far

In the first reporting period (February 2010 – February 2011) the project's focus has been on systematical gathering of user needs and requirements, on the system architecture, on the technological aspects of the KSERA system and on the preparations required for successful field trials in later stages of the project.

In line with the foreseen schedule, the consortium has developed the following set of activities:

1. **Needs assessment of possible usage scenario**: the specific needs of users have been analyzed and resulted in a comprehensive description of the KSERA *Scenarios, Use cases and Personas* and the basic rules for *Ubiquitous Monitoring*. The different types of scenarios were ranked according to their importance, so as to be included in the first prototype, to be produced. An updated version of different scenarios integrating the recommendations received during the interim mid-term review was drafted.

Members for the Ethical Advisory Board (EAB) were nominated. Needs for ethical clearance in Austria, Israel, and the Netherlands were clarified and ethics committees were also identified and contacted. Different programming documents for the implementation of the trial were produced, according to the recommendations provided during the interim mid–term review.

2. **Design of the system architecture for the mobile platform, the assistive technology and the human-robot interaction interface**: the Robot Mobile Behaviour was developed and resulted in a thorough report on the KSERA architecture and implementation details. This report was updated according to the recommendations of the interim mid–term review.

A person interacting with Nao

Great progress was made for the development of the middleware architecture using the ROS middleware solution (Willow Garage). Various software modules of low-level robot behaviour were developed and integrated using ROS such as a person localization system, a dynamic navigation algorithm and a model of a user's personal space.

3. **Analysis of the Human Robot Home interaction:** advanced algorithms have been implemented in order to build up basic functionalities needed to put Nao in contact with the target person: when operative, Nao will be able to track the face of the person and to estimate its head pose. Through this type of connection, the robot will actively interact with the person and give instruction at appropriate times for his daily activities (i.e. physical activities, information about important data for the health of the person, etc.). A first lab prototype of Nao equipped with a beamer was created and implemented successfully. An improved prototype (smaller and lighter) is in its final phase of implementation.

4. **Overview of sensors and sensors network for ubiquitous data monitoring:** the selection of off-the-shelf devices to measure the physical conditions and environmental sensors has been analyzed and resulted in a report that enumerates the classes and the devices that will constitute the KSERA Ubiquitous Monitoring System. The report explains how these data will be used to achieve the goals stated in the Use Cases and Monitoring Rules. During one of the meetings the possible prioritization of the classes of the sensorial devices to be used in KSERA was brought about.

Costs and benefits have been taken into consideration during this phase so the keep the system as cheap and flexible as possible: tools such as using web services for weather forecast were used in order to reduce the costs of the implementation of the project (Nao can give instructions to the person, for instance, in relation with the specific outdoor environment).

5. **Development of a trial plan in real user environments including ethics and safety issues** (**Prototype Integration & Validation)**: this involved planning of the study design, user involvement processes, environment, trial documents and organizational issues. The results will constitute a framework and the guideline for the pre-trial, testing and post-trial phase, so that a smoothly running evaluation will be guaranteed. The described workflows for studies in real user environments together with Socially Assistive Robots (SAR) and vulnerable target groups can be used as basis for ongoing research activities in the research area of Assistive robots and Human-Robot-Interaction.

6. Communication activities: a website of the project (http://www.ksera-project.eu) was designed and is currently operative. A project leaflet has been produced and distributed during several events. The press was approached in all countries concerned by the project and this resulted in a number of references to the project on the web and in local newspapers. The project was also presented at the Eindhoven local TV station and on the Dutch national radio. A press conference was organized in Turin in December 2010 and at the Parliament of Israel in January 2011. The first scientific conference publications were also submitted and accepted[1]. These papers describe the first results of the ongoing work about robot navigation and gaze tracking.

Students have been involved in various research projects connected to the KSERA project and specific lectures have taken place and are being organized.

KSERA also collaborates with several other projects such as ROBOEARTH, Robo M.D. and FLORENCE mostly for exchanging scientific knowledge, robot software and organizing dissemination events.

A document on standardization has been produced: this describes the relevant standards determining the inter-operability of the KSERA system with the external applications, which might be envisaged for the future exploitation of the KSERA results.

7. **Development of a risk management plan**: the main results are the assessment of the project risks and the construction of a risk plan. Further outputs are the interim progress report for the first period and the first annual progress report. The project is running smoothly, regular conference calls and progress meetings took place in 2010 and the planned milestones have been achieved.

[1] At the European Conference on Cognitive Ergonomics (ECCE 2010), 25-27 August 2010, Delft, The Netherlands, and the International Conference on Human-Robot Interaction (HRI 2011), 6-9 March 2011, Lausanne, Switzerland.

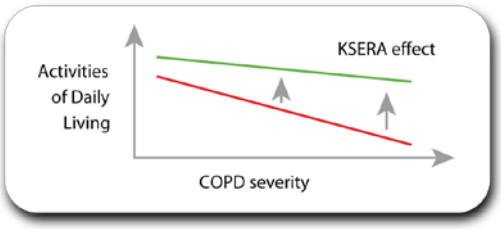
1.3 Expected final results and potential impact and use

The **applications** include:

- A mobile assistant to support and interact with an older person.
- Delivering useful communication (video, internet) to an older person.
- Advising an older person or caregivers about anomalous or dangerous situations on the basis of health and behavioural monitoring.

The **expected impact** is:

- Increasing the acceptance and adoption of service robots in domestic environments.
- Increasing independence and improving the quality of life (QoL) for older people, in particular those affected by COPD.
- Decreasing burdens on families and caregivers.
- Decreasing healthcare costs.



1.4 Additional information

The project website www.ksera-project.eu provides more detailed information on the project, including KSERA-related events, collaborations, public reports and contact information.

The KSERA project partners are:

- Technische Universiteit Eindhoven (TU/e)
- Istituto Superiore Mario Boella (ISMB)
- Maccabi Healthcare Services (Maccabi)
- Technische Universität Wien (TUW)
- CEIT RALTEC gemeinnützige GmbH (RALTEC)
- Consoft Sistemi S.P.A. (Consoft)
- Universität Hamburg (UH)

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