

An Enhanced Ambient Assisted Living Experiment for Older People with Multiple Chronic Conditions

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Abstract—The new European-funded eCAALYX project (Enhanced Complete Ambient Assisted Living Experiment—June 2009 - May 2012) is building on the strengths and experience acquired in the original CAALYX project (2007-2008). It takes the 24/7 monitoring of the health and well-being of healthy older people that was developed in CAALYX (with special emphasis on outdoors/mobile scenarios) one step further by refining it and making it available to older people with multiple chronic conditions (with additional strong emphasis on home-based care and lifestyle management components).

I. INTRODUCTION

EUROPE is facing major socio-demographic changes. The ratio of elderly people to the entire population is constantly growing, while the corresponding ratios of younger age groups, especially the working population, are decreasing. Furthermore, ageing combined with an increasing burden of chronic, concurrent diseases threatens to make the current models of healthcare unsustainable. Ambient Assisted Living (AAL), as a specific user-oriented type of “Ambient Intelligence”, may greatly help in this situation.

It has been demonstrated that the prognosis of certain chronic diseases is noticeably improved through strict control of the associated risk factors. However, both physicians and patients find it difficult to carry out such a strict control, a fact that often leads to suboptimal control of the disease. On the other hand, patients often lack the necessary motivation or information to follow health recommendations with constancy. Additionally, the complexity of medical pharmacological treatments, especially that of multiple, concurrent treatments, as well as possible drug interactions and unwanted side effects further impair patients’ compliance with the therapy. Likewise, a significant proportion of medical recommendations do not adhere to clinical guidelines specifications. Physicians often skip some recommendations, do not tackle all risk factors,

and consider suboptimal control of them to be enough.

This situation is especially severe for elderly people, who suffer from multiple chronic diseases. Interrelations between multiple risk factors and pathologies, numerous recommendations and treatments, pharmacological interactions and adverse side effects of various drugs make compliance with recommendations especially difficult for both patients and physicians.

II. A NEW PROJECT IS BORN: ECAALYX

eCAALYX—Enhanced Complete Ambient Assisted Living Experiment (June 2009 - May 2012; <http://ecaalyx.org/>) is a three-year project funded by the European Commission (EC) under the AAL Joint Programme (<http://www.aal-europe.eu/> — Strategic Objective addressed: ICT-based Solutions for Prevention and Management of Chronic Conditions of Elderly People). The AAL Joint Programme is also funding a number of related projects, e.g., AMICA (Autonomy, Motivation & Individual Self-Management for Chronic Obstructive Pulmonary Disease—COPD patients — <http://www.amica-aal.com/>), which reflects the growing need for developing these types of solutions across 21st century Europe.

The eCAALYX project builds on the strengths of the infrastructure and functionality already developed in the original CAALYX project (2007-2008) that was also funded by the EC under the Sixth Framework Programme (FP6) [1,2]. Six of the participants in new eCAALYX project were members of the original CAALYX project consortium, with four new participants joining them in eCAALYX (Fraunhofer Portugal; CETEMMSA Technological Centre, Spain [project coordinator]; Ev. Krankenhaus Witten GmbH, Germany; and TeleMedic Systems, UK). Table 1 lists all partners in the new eCAALYX Project Consortium.

III. OBJECTIVES AND SELECTED HIGHLIGHTS

eCAALYX’s objectives can be summarised as follows:

- 1) Health monitoring of older and elderly persons with multiple chronic conditions, at home and on the move (the original CAALYX did not cover the health monitoring and management of older people with *comorbidity*).
- 2) Improving the quality of life of elderly persons by increasing their freedom and safety. This is achieved by promptly detecting and controlling any unfolding

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The eCAALYX Project Consortium includes 11 member organisations in five European countries (e-mail: ecaalyx@ecaalyx.org).

TABLE I
ECAAALYX CONSORTIUM PARTICIPANTS AND THEIR WEB SITES

Participant	Web Site ^a
CETEMMSA Technological Centre, Spain (project coordinator)	http://www.cetemmsa.com
Corscience GmbH & Co KG, Germany	http://www.corscience.de
Ev. Krankenhaus Witten GmbH, Germany	http://www.evk-witten.de
Fraunhofer Portugal	http://www.fraunhofer.pt
Fundació Hospital Comarcal Sant Antoni Abat, Spain	http://www.fhcsaa.cat
INESC Porto – Instituto de Engenharia de Sistemas e Computadores do Porto, Portugal	http://www.inescporto.pt
National University of Ireland, Galway, Ireland	http://www.nuigalway.ie
Telefónica Investigación y Desarrollo, Spain	http://www.tid.es
TeleMedic Systems, UK	http://www.telemedicysystems.com
University of Limerick, Ireland	http://www.ul.ie
University of Plymouth (Enterprise Ltd), UK	http://www.plymouth.ac.uk

clinical decompensation episodes, so that the persons' independent life at home can be extended and their hospitalisation or admission in nursing homes avoided for longer periods. Besides improving the elderly person's quality of life, this approach will also result in various cost reductions and in relieving some of the growing burden on acute care/healthcare systems.

- 3) Preventing the deterioration of the patient's condition by providing continuous support, guidance, and relevant health education via a special TV-based Set Top Box (STB) system (Fig. 1—the original CAALYX did not have such *strong home-based components* [3] for the delivery of education on leading a healthy lifestyle).
- 4) Achieving all of the above goals by providing a solution that is *commercially viable*, acceptable by all users/stakeholders, reliable, long-term, flexible, scalable, and virtually maintenance-free in non-technical environments, thus suitable for real-world deployment.

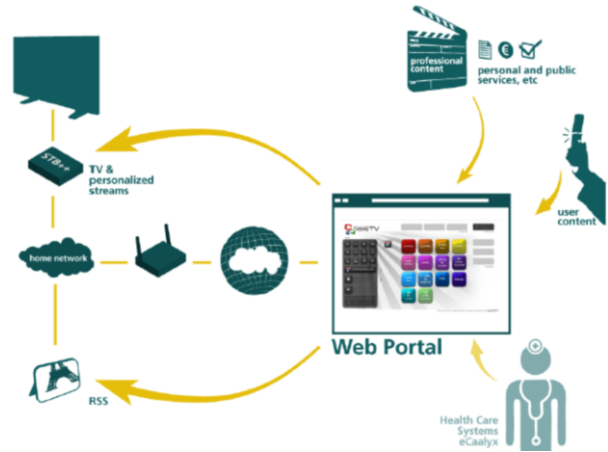


Fig. 1. Franhofer's novel STB++ in eCAAALYX's Home System: Multi Play Set Top Box System for Target Group Specific Content Delivery [3].

eCAAALYX is composed of three main interconnected subsystems:

- 1) The Home Subsystem, which includes the Customer-Premises Equipment (CPE), STB and interactive TV (to deliver health education and other functions—Fig. 1), as well as what we call a 'Tricorder' device combining additional home sensors that are stationary and not continuously worn on the body or included in the smart garment (see below);
- 2) The Mobile Subsystem, which includes a smart garment, with vital signs sensors integrated into a wireless Body Area Network (BAN) of Wearable Body Sensors (WBS), and a mobile phone; and
- 3) The Caretaker Subsystem/Site, which includes the remote Caretaker Server and the Auto-configuration Server.

Practical deployment aspects such as remote management and auto-configuration mechanisms will be developed such that long-term large-scale deployment is possible with reduced operating costs. Another novel feature in eCAAALYX is the use of smart garments [4]. These are comfortable washable garments with specialised conductive areas that can, for example, function as heart rate/ECG (electrocardiogram) electrodes when in contact with the skin.

Finally, eCAAALYX will be easily integrable into the contemporary technological infrastructure of most European network operators and homes, and will also be available when users visit their second homes, e.g., while on holidays in southern Europe or during extended stays with relatives living in different locations, including in other European countries than the person's home country.

IV. CONCLUSIONS

eCAAALYX aims to facilitate physicians' and patients' compliance with optimal recommendations and guidelines for the treatment of multiple chronic health conditions. It

will allow comprehensive and coordinated global management by different clinicians of patients suffering from comorbidity, resulting in a much more efficient and effective treatment, reducing avoidable hospital admissions, improving clinical outcomes and quality of life, and keeping people in their home environment for longer.

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