

# AMICA telemedicine platform: a design for management of elderly people with COPD

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**Abstract**— The aim of this work is to establish some basic methodological aspects that should not be ignored in the arduous task of the development of telemedical platforms for the efficient control and management of chronic elderly patients. Among the main methodological proposed concepts should be: an integrated market-oriented approach, a user-centered design, an evaluation-driven development and a work plan organization. This work presents the methodology applied to Autonomy, Motivation, & Individual Self Management for COPD (Chronic Obstructive Pulmonary Disease) Patients (AMICA), project funded by the European Union (EU).

## I. INTRODUCTION

Recently, telemedical systems for elderly people with chronic conditions have been developed to help patients, caregivers and general practitioners control and manage different chronic diseases, avoiding the need of frequent visits to medical centers and providing an easy, specific and safe way to control and manage their illness [1] [2] [3] [4] [5].

These telemedical systems are composed of different sensors and devices, often embedded in a wearable system, and are in charge of obtaining different health-related measures. As pointed out by [6] there are many reasons for the presence of computers in healthcare, the most important of which are reduction of costs and improvements in the quality and effectiveness of care. However, only a few health telemedical products and services for elderly people with chronic conditions can be currently seen in the market for commercial exploitation as a consequence of two important factors:

- a. Technologies have not taken into account the actual user needs in their development.
- b. There is a lack of understanding of market mechanisms.

In this work some basic methodological aspects in the creation and development of telemedical platforms dealing with chronic elderly patients is established. The below mentioned guidelines followed in the execution of the AMICA, project, are aimed at the improvement of the development and implementation phases of such telemedical solutions. These telemedical solutions have traditionally lead to unsuccessful transfers to the market and, thus, the creation of such platforms should take into account:

- The health limitations of the group for which such platforms have been created.
- A comprehensive definition of the types of users considering not only patients but doctors, caregivers, families, institutions and centers, etc.
- A design focused entirely on the user.
- An evaluation-driven development.
- An integrated, market-oriented approach
- A work plan organization.

The paper is organized as follows: Section II gives a description of the issues of the elderly and information technologies; Section III suggests the methodology for the design and evaluation, Section IV describes the demonstration techniques and the pilot applications and finally Section V offers some discussion and conclusions.

## II. ELDERLY PEOPLE AND INFORMATION TECHNOLOGIES

Information Technologies can be applied to the service of elderly people and their chronic diseases. Such technologies allow the elderly not only to be assisted by a health care institution but also to improve their quality of life and to self manage their disease. This means that the elderly can be given an active role in the use of these new systems. Likewise, information technologies must be taken as an extension of the services and activities offered to patients, not as a substitution; dependency is not eliminated but redistributed [7][8][9].

These technologies are sometimes the only support within the reach of these patients. The design of any system must guarantee communications security, user privacy and the protection of information as established by the law and as a way to improve the user evaluation and to avoid rejection of the system [10][11].

This kind of communication platforms must also take into account possible user disabilities, such as reduced sight or low mobility. Consequently, the system must include

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different possibilities of interaction such as interaction by voice, touchable screens or optical card readers [9]

Because a solution involving so many different kinds of users needs to be developed, it is first mandatory to establish a precise definition of the actors of the telemedical platform. In this respect, the E.U. provides a definition of the different types of final users in the framework of the Ambient Assisted Living (AAL) Joint Programme [12]. Thus, the defined groups are as follows:

- *Primary-end user (PEU)*: A PEU is “the well-being person”, a single individual. This user will be directly benefited by an increased quality of life.
- *Secondary-end users (SEU)*: SEU are people or organizations in direct contact with primary end users.
- *Tertiary-end users (TEU)*: A TEU are those institutions and private or public organizations which are not in direct contact with the Telemedical products or services, but somehow contribute to organize, pay or enable them.

### III. CONCEPT AND METHODOLOGY

Figure 1 shows how the telemedical platform is being developed for the EU AMICA Project according to [13]:

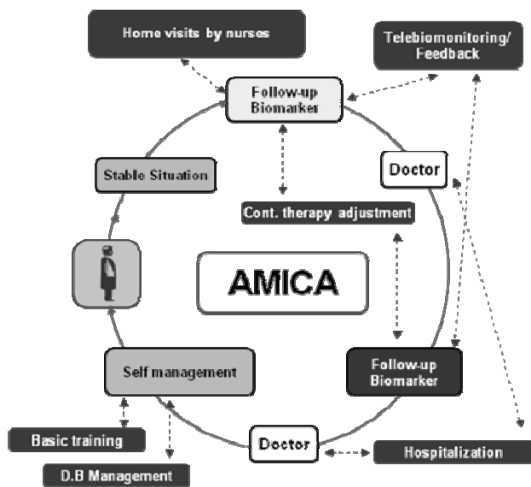


Figure 1: Telemedical Platform for AMICA Project

In order to overcome those common flaws of telemedical research projects, a main emphasis on challenges regarding the transfer of research results into innovative and commercially successful products and services should be placed. In parallel to the information and communication technologies (ICT) system, a professional care service and concept-based disease management should be developed as well as a business model respectively. Main methodological concepts are:

- Integrated market-oriented approach

- User-centered design
- Evaluation-driven development
- Work plan organization

#### A. Integrated market-oriented approach

To tackle the obstacles concerning the dissemination and exploitation of the solution, the parallel development of a technical solution and an economic concept (stakeholder analysis, service engineering and business models) ensures that the project results will be translated into valid, widely accepted services and products.

#### B. User-centered design

User-centred design process (Figure 2) emphasizes the early end-user inclusion.

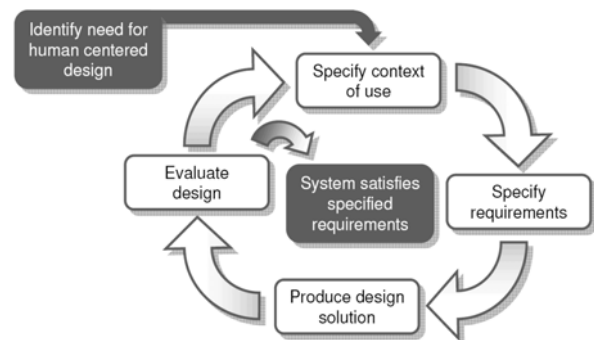


Figure 2: Evaluation-driven, user-centred design process

Apart from interviews and focus groups, the following specific instruments for end-user involvement should be accounted for:

- 1) *Scenario Workshops* [14]: The Scenario Workshop tries to reveal and show possible future developments and problems in a certain area. Basically, it allows to identify and discuss the differences and similarities of problems and solutions as perceived by different groups of participants.
- 2) *User Panels* [15]: Used to obtain the view, experiences and expectations of different users. Subsequently, user panels allow prototypes to be shown to end-users. The users are then asked to discuss about the prototype and make suggestions for changes. Technologists, in general, have little understanding of the users' needs and priorities. In the field of elderly care, researchers are prone to generalize experiences within their social environment, often leading to misinterpretation of user needs. On the other hand, users – in this case elderly people, their relatives and caregivers– are not aware of what is technologically possible.

#### C. Evaluation driven development

In order to enable an effective dissemination and exploitation of the project results, an evaluation-driven

development approach is planned for the development of the project system, processes and use cases. In contrast to traditional development processes, a more iterative, rapid prototyping-based approach will be used, where intermediate quickly produced solutions can be evaluated in the lab or in the real world. Feedback is then used to develop the next prototype and adjust the technology to the findings of the evaluation round. This reflects the strong need for early end-user involvement.

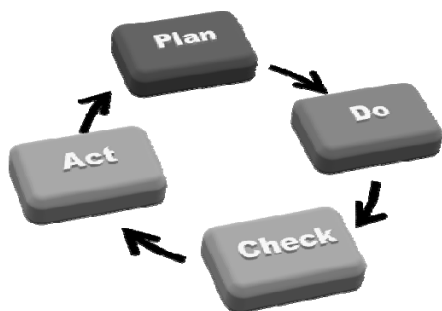


Figure 3: Demming Circle

Demming Circle (Figure 3) is used on the Evaluation-driven development, in order to ensure an early identification and solution of user acceptance problems and innovation barriers, thus facilitating the exploitation of project results.

#### D. Work Plan (Organization)

In order to achieve the objectives of the interdisciplinary researches with a mixed contribution coming from medicine, engineering, social science and economics are required to work together. Work packages (WPs) are organized into a matrix structure consisting of research and development (RTD) activities (vertical) and horizontal activities targeting project management, in contrast to “classical” research projects based on sequent pre-planned activities. The WPs are mainly executed in parallel during the whole project time. It reflects the iterative, evaluation-driven research methodology (Table 1).

#### IV. DEMONSTRATION OF THE OBJECTIVES AND PILOT APPLICATION

The demonstration activities are an integral part of the user-centred evaluation-driven research approach. Figure 4 shows the two stages of the pilot application.

Demonstration activities and pilot applications allow potential users to get involved early in the process of designing and developing new products, services and systems. Costly misconceptions can be avoided and user-friendliness and acceptance are increased.

First step will be a demonstration of the telemedical system focusing on short-term evaluation of aspects such as usability and end-user acceptance. The second and final step include a long-term pilot application of the whole disease management solution with the intention of a first early

evaluation of effects on disease progression, quality-of-life and patients’ compliance as well as the sustainability of the developed service and business concept.

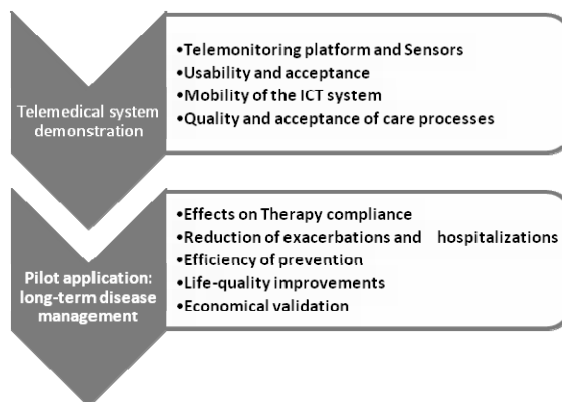


Figure 4: Project pilot application

To fulfil the requirements of the market, the project’s developers will analyse stakeholder needs and requirements in direct cooperation with the end-users.

To satisfy the specific needs of each user, application scenarios and solution concepts might be designed within scenario workshops. Key issues should be identified so as to specify the context of use, specific requirements, produce design solutions and the evaluation design.

Therewith the end-users will be involved in the following tasks:

- Definition of the needs according to user and physicians’ point of view.
- Contribution to the development of ergonomic devices and to the study of human machine interfaces (HMI) usability.
- Creation of a research database.
- Development of a consistent product.
- Mediation between researchers and end-user to test the system.
- Consideration of test subjects’ fears and needs.
- Provision of test users.
- Regular meetings between researchers and users.

End-user involvement will be especially strong in the demonstration and evaluation activities. Continuous improvement of the disease management processes and ICT solutions for the user panel have to be demonstrated to end-users in each transition project phase. These demonstrations match the check of quality control. Existing solutions should be discussed; room for improvement also and especially solutions acceptance and usability have to be identified. Following the subsequent end-users’ check action, plans should be elaborated and implemented.

TABLE I  
RTD'S ACTIVITIES AND HORIZONTAL ACTIVITIES IN AMICA PROJECT

		Horizontal Activities		
RTD Activities	WP1 Sensors technologies and Biomedical Engineering	WP7 User Inclusion & Field Trial	WP8 Dissemination & Exploitation Related Activities	WP9 Project Management
	WP2 Medical Foundations for Preventions, Diagnosis & Therapy			
	WP3 Telemedical Platform and Medical System Integration			
	WP4 Usability and Human Machine Interaction			
	WP5 Healthcare Processes and Disease Management			
	WP6 Health Economic , Service & Business Model			

## V. DISCUSSION AND CONCLUSION

The AMICA project will try to change the way healthcare services are offered to COPD patients by introducing new means for quality health care management that improves the patient's quality of life.

The general objective of any telemedical system for chronic patients should be to perform a long-term disease management solution based on innovative ICT. In this sense, AMICA will try to develop a solution that merges: a market-oriented approach by integrating sustainable business models for products and services based on existing healthcare market structures and regulations, a user-centered design and an evaluation-driven development oriented to implement systems and services that are easy to use for elderly patients. At the same time, these systems aims at facilitating mobility and social integration of people with chronic conditions, encouraging prevention and self-management of the situations and risks through immediate, comprehensive feedback and efficient case management services. Last but not least, a work plan organization to achieve the objectives of the project maximizing the resources of interdisciplinary researches from the diverse fields of technical and social sciences is also developed.

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