

28 May, 2007

# Ambient Lighting Assistance for an Ageing Population

## ALADIN

European Commission  
Information Society and Media



The Specific Targeted Research Project ALADIN (IST-045148) wants to enable elderly people to live at home autonomously for a longer time by harnessing the impact of light to increase their quality of life and sense of wellbeing.

### At a Glance

#### Project:

ALADIN aims at developing an assistive system based on ambient lighting to support individual mental performance as well as relaxation in specific situations of older adults. The adaptive interfaces should help elderly people to "age in place", that is, remain living in their home for longer periods of time.

#### Project coordinator:

University of Applied Sciences Vorarlberg GmbH, Austria

#### Partners from:

Institute for Social Research and Opinion Polling OHG (Italy), Bartenbach Light Laboratory GmbH (Austria), Becker Meditec (Germany), Budapest University of Technology and Economics (Hungary), Generation Research Program of Munich University (Germany), and University of Bucharest (Romania).

#### Duration:

January 2007 – December 2008

#### Total cost:

2,600,000.- Euro

#### Programme:

FP6 IST Call 6 Ambient Assisted Living

#### Further information:

[www.ambient-lighting.eu](http://www.ambient-lighting.eu)

### Setting the scene

Light affects the elderly mainly in terms of sleep quality, changes of mood and cognitive performance. When installing lighting systems in the homes of the elderly, quantity, spectrum, timing, duration and spatial distribution are important characteristics to be considered. In addition, special age-related impairments have to be taken into account. Physiological and pathological changes in the eye like cataracts or long-sightedness often lead to impaired vision, which makes higher standards in lighting in older people's homes necessary.

Ageing may also lead to a deterioration of circadian rhythms, i.e. our "inner clock". This can result in sudden psychophysiological deactivation or low alertness levels during wake phases on the one hand and night-time awakening on the other. Adaptive lighting can contribute considerably to sound sleep and a regular sleep-wake cycle, which are essential to preserve and enhance people's state of health.

### Objectives

The overall aim of ALADIN is to extend our knowledge about the impact of lighting on the wellbeing and comfort of older people and translate this into a cost-effective open solution. The ALADIN prototype promises to revolutionise the permanent lighting industry and comprise the following components:

1. An intelligent open-loop control and biofeedback system which can adapt various light parameters such as intensity, light directions or colour in response to the psycho-physiological data, which are continuously registered by the system.
2. A control system that can be manually adjusted via graphical interfaces and allows the resetting of all light parameters to their default values. To achieve truly ageing friendly interfaces design-for-all principles will be applied which take into account changing levels of capability due to age.
3. An application that can assist older people in better understanding their own affective-cognitive states including their circadian rhythms and enable them to take responsibility for regulating them. This, in turn, will help them accomplish their daily activities.

Due to its open architecture, the system can easily be extended to include other environmental factors such as temperature, acoustics, colour or information displays and other application domains and target groups and thus become part of a general assistive environment

## Approach

ALADIN aims at developing an intelligent assistive system based on ambient lighting to support mental alertness and memory performance, e.g. when solving a crossword puzzle. At the same time, lighting can be adapted to support relaxation in certain situations. The system is also expected to assist with regulating circadian rhythms, i.e. our inner “clock”. Certain diseases particularly common with the elderly such as dementia lead to changes in endogenous circadian rhythms.

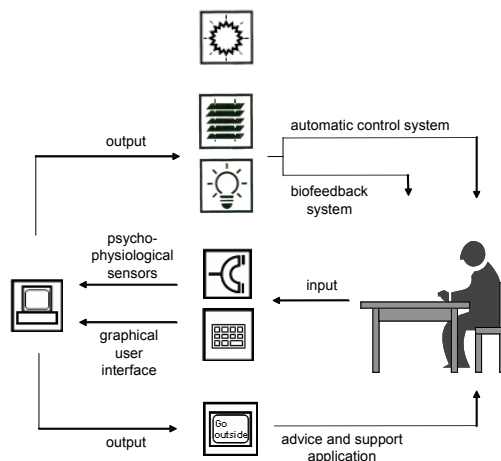
The capturing and registering signals such as skin conductance, heart rate or body temperature as well as mental activity and muscle tension has to happen continuously and be integrated into people’s normal living environment. For this purpose, we intend to use smart biosensors as well as environmental sensors. Analysis and interpretation of the signals captured from

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these sensors make the system aware of the events and activities in its surroundings. The system receives the information about the impact of differences in the luminous environment on an individual’s affective and cognitive state as reflected in the psycho-physiological signals. It monitors if and to what extent these signals approximate the previously defined target values for relaxation or mental performance.

Subsequently, artificial intelligence techniques such as genetic algorithms, fuzzy systems or neural networks are used to achieve the lighting best suited to the individual and/or to a particular situation. It will not be necessary to know in advance what kind of lighting is to be achieved when conceiving the adaptation algorithms. Instead, optimisation will be incremental and happen in an evolutionary manner in response to and in accordance with the biosignals the system receives.



Lab tests are conducted to examine the psycho-physiological reactions triggered by certain light parameters and how these can be influenced by changing the parameters as well as to define target values for the control system for both relaxation and activation. Subsequently, the ALADIN prototype will be evaluated by twelve older adults in field tests that last three months.

By developing an assessment system that captures and analyses the individual and situational differences of the cognitive and emotional effects of lighting, ALADIN will go well beyond the current state of the art of compensation systems for older adults.