Use Cases Functionality of the OASIS HCI

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Abstract. Within OASIS, a set of detailed Use Cases have been developed, after capturing the specific needs of elderly users on the use and acquisition of services for the support of their every day life. These use cases offer direct input to the design and development of the user interaction elements in terms of key characteristics, such as self-adaptivity and personalisation parameters that abide to the devices capabilities and environmental restrictions and satisfy the user personal needs and wants.

Keywords: use cases, personalisation, user needs, self-adaptation, independent living, autonomous mobility.

1 Introduction

OASIS Integrated Project (co-funded by the EC, under the 7th FP), introduces an innovative, Ontology-driven, Open Reference Architecture and System, which will enable and facilitate interoperability, seamless connectivity and sharing of content between different services and ontologies in all application domains relevant to applications for the elderly and beyond.

A Use Case, as a description of an actor's interaction with the system to be designed, is both a description of the system's user interface and an indirect description of some function that the system will provide (Ferg S., 2003). Thus, the use case is a powerful description to preview and analyze the functionality of a system and its human-computer interaction characteristics, to satisfy the user needs. There is a narrow area where the real world interacts directly with the system and this is exactly the use cases area.
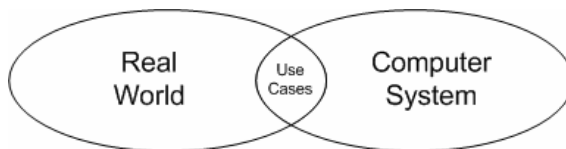

Fig. 1. Use cases as an interaction between the real world with the computer system (Ferg, 2003)

A Use Case is made up of scenarios. Scenarios do not just refer to what the system can do, but also refer to those interactions that the system must be able to identify as invalid (e.g. error conditions and exceptions). Scenarios consist of a sequence of steps to achieve the goal, which define the interaction level between user-system; each step in a scenario is a sub goal of the use case. As such, each sub-goal represents an autonomous action that is at the lowest level desired by our use case decomposition. This hierarchical relationship is needed to properly model the requirements of a system being developed, including the technical characteristics of its operation and its interaction by the potential user. In addition, it helps avoid the explosion of scenarios that would occur if we were to try to simply list all possible ways of interacting with the system.

In the current paper, the OASIS Use Cases (UCs) are presented, discussing also their impact and contribution to the HMI design and development. Also, a sort explanation of the methodology followed for the definition of the UCs, is provided.

2 Methodology

The work started with a technological benchmarking on mobility issues and smart workplaces, which led to the identification of relevant gaps. Next, face-to-face interviews were realised in five countries (with 38 carers and 132 elderly users), in order to find the elderly users specific needs.

A thorough literature and market survey has been performed in the area of services for the every day support of elderly people. Not only past and existing systems have been collected and reviewed, but also relevant projects and services. Issues that have been considered are related to technological aids, systems and services to support the elderly in pre-trip and on-trip info, using public and private transportation means, as well as flexible on-demand services, utilizing specialized travel packages. Furthermore, the support of the elderly as tourists or workers, working from home or at the workplace without a fixed office, or even as mobile workers has been taken into account. Also, independent living applications and services are included, such as health monitoring, home automation, memory enhancement, physical activity management, etc.

All the retrieved results have been directly inserted in an on-line database that has been developed in the framework of OASIS, allowing clustering of and a structured presentation of the results. The database of relevant technologies provides useful information for each identified entity, such as relevant technical characteristics, costs and producer/promoter details, as well as - when available - information on compliance to an ontology, applications used in, type of users, method of use, usability issues, etc. Currently, the database consists of 601 Products, 33 Services and 46 Research Projects.

The main issue before extracting the Use Cases for OASIS was the development of an adequate format to describe them. Thus, an analytic template has been developed in order to identify and describe as thoroughly as possible the Use Cases, and the way they should be formally described. Most of the defined areas, constitute a significant source of input to the human-computer interaction design and development of the project, for the relevant system/module that each UC refers to. The following table presents these areas, including their relation to the HCI issues.

Table 1. OASIS UCs analysis areas and their relation to HCI issues

Issue	HCI relevance	Comments
Context of use (aim)	~	Partially relevant, i.e. only for those UCs the their aim depicts directly the HCI characteristics
Primary actor	√	Directly relevant, as the user specific needs and wants determine the self-adaptivity of content/info presentation and their accessibility parameters.
Secondary actor(s)	√	As above, but the needs of those actors in term of the UI will not be satisfied with the same details as above.
Connected UCs	~	Partially relevant, i.e. only in case that there are connected UCs that determine the design and behaviour of the human-computer interaction.
Priority Level	√	High priority UCs (see explanation on the prioritisation levels in section 2.3) fulfil all the OASIS goals in terms of the self-adaptive, personalisation interaction strategies.
Scenario(s)	√	The detailed scenarios (each UC consists of several scenarios) give more detailed info for the build-up elements and behaviour of the system-user interaction.
System output	√	Totally relevant to the system HCI design.
Relevant OASIS WP	-	
Services involved	√	The number and type of involved services give an insight on the system interface characteristics.
Devices & restrictions	√	This is one of the basic parameters that study on the level of user interaction needs to take into account. Also, alternative HCI concepts must exist for certain key services.
Critical success parameters	~	Partially relevant, i.e. if one or more of these parameters relate directly or indirectly with the HCI concepts.
Environmental restrictions	~	Such limitations need to be known by the system, in case of need to provide info to the user with alternative means/ components.
Interaction level	√	Self-evident that this issue is highly relevant to the HCI.
Personalisation/ adaptation level	√	Fully relevant, as the personalisation parameters relate also to the type and the way of info provision to the elderly user.
Quality of service indicators	~	Partially relevant, i.e. only if the indicator concerns HCI issues.
Potential input needed from other UCs (what input and which UCs?)	~	Only in case this input is related to the user interaction concept.
Important accessibility attributes (per UG)	√	These attributes affect directly the UI appearance and functionality.
Background info (reason on assigning the priority)	-	

Thus, the UCs analytical descriptions, based on the above fields, provide a significant contribution for the HCI development in terms of its functionality, adaptivity, interaction, personalization, etc.

2.1   Use Cases Clustering

An important feature of the Use Cases is that their "names" should reflect users' goals and should immediately convey meaning. Taking this into consideration through all

processes, Use Cases provide a number of examples containing scenarios of use for OASIS, which should be of great utility for the work being developed by partners, but also for stakeholders and users.

Use Cases categorisation helps dealing with the large number of Use Cases for OASIS. This is considered as a clustering technique that separates UC's by subject area. The subject areas are according work distribution, being thus distinguished in two main fields:

- Independent living applications.
- Autonomous mobility and smart workplaces applications.

The use cases are presented (in section 3) based on the above fields. Furthermore, for each of these 2 fields, several sub-areas are defined, which consist of groups of UCs.

2.2 Use Cases Prioritisation

In order to distinguish Use Cases in terms of value or primacy for OASIS stake-holders (users, users' representatives or other interested entities) as well as in terms of importance for system operation, 3 categories of prioritization are set:

- Essential
- Secondary
- Supportive

Therefore, each Use Case description encloses a level of prioritization. The 'essential' and 'secondary' UCs are the ones that have to be tested in the project pilots, while the 'supportive' ones will be tested only if the specific UC is not covered/tested through another UC. The justification of assigning a specific priority level to the UCs has been provided from each UC provider. As said above, the 'essential' UCs are the ones that have to ensure the automatic adaptation and personalisation features of the system.

3 The OASIS Use Cases

The project UCs are presented in the next 2 sections, per area that they fall to.

3.1 Independent Living Applications Use Cases

There are 60 UCs determined for this area. Many of them relate to each other, by giving/getting input. All the UCs fall in 6 main groups. The list of the main and secondary groups is given below:

- **Category 1: Nutritional Advisor**

    - Nutritional profile definition & personalization
    - Nutritional Plan builder
    - Nutritional Empowerment & assessment
    - Shopping and cooking assistant

- **Category 2: Activity Coach**

  - Activity monitoring multisensorial system
  - Activity characterization
  - Activity Management
  - Rehabilitation support system
  - Fall and other accidents detection
- **Category 3: Brain and skills trainer**

  - Specific cognitive training exercises and activities
  - Stress management exercises
  - Daily activities simulation
- **Category 4: Social Communities platform**

  - Enhanced web experience
  - Collaborative web experience
  - E-learning and Infotainment environments
  - Recreation for the elderly
- **Category 5: Health monitoring**

  - Health profile definition& personalisation
  - Health remote monitoring
  - Health Coach
  - Alerting and assisting applications
- **Category 6: Environmental Control**

  - -n-door user localisation
  - Environmental control applications
  - Intelligent home management

Generic representation diagrams have be produced for each of the main categories above, but also per UC. An example of such a diagram follows below for Category 2: Activity Coach:
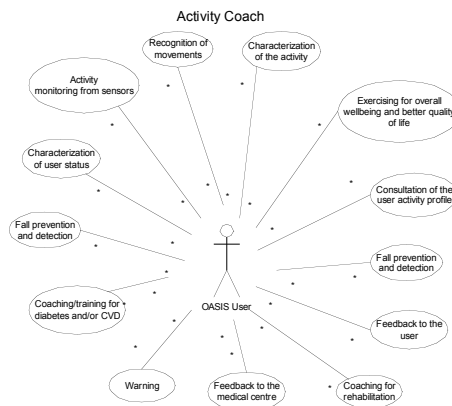
Fig. 2. Activity Coach generic Representation Diagram

The complete set of the UCs is shown below:
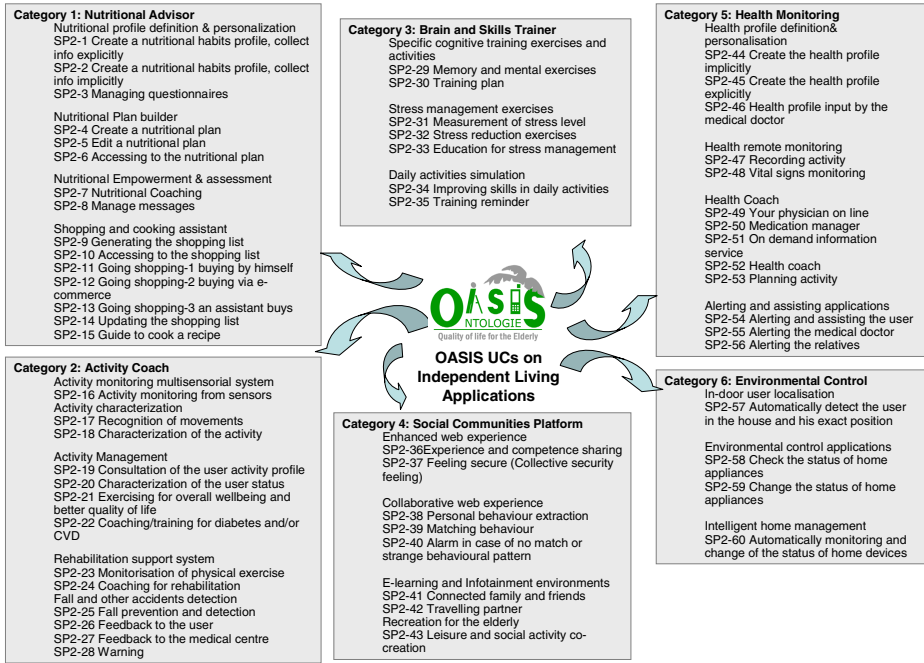
Fig. 3. The OASIS UCs on independent living

3.2   Autonomous Mobility and Smart Workplaces Applications Use Cases

There are 38 UCs determined for this area. Many of them relate to each other, by giving/getting input. All the UCs fall in 4 main groups. The list of the main and secondary groups is given below:

- **Category 1: Transport information services**
  - Pre-trip info
  - Short range trip info
  - Info in stations and hubs
  - TMIC interface
  - Long-range trip info
  - Multimodal trip planning
- **Category 2: Route guidance**
  - In-vehicle
  - Pedestrian
- **Category 3: Personal mobility**
  - On-demand services
  - Driver telematic support

- Driver comfort support
- Tourism and leisure

- **Category 4: Smart workplaces**

  - Smart workplaces
  - Telematic tools and technologies for flexi-work

As in section 3.1, generic representation diagrams have been built for the main categories, as well as each UC individually. The following figure shows the set of UCs:

Category 1: Transport information services
Pre-trip info
SP3-1 Plan a trip
SP3-2 Plan a special attributed trip
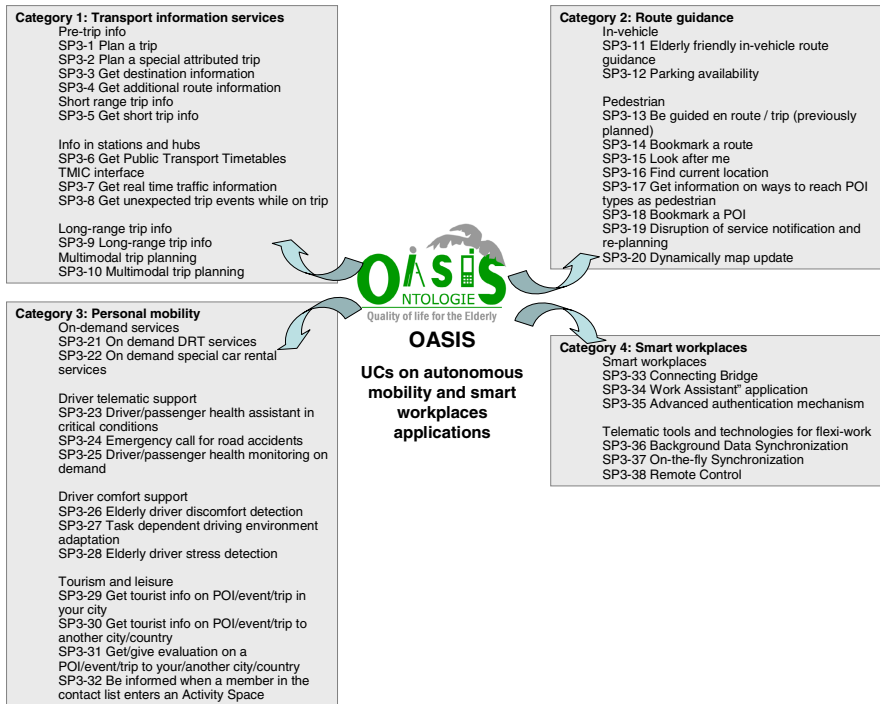SP3-3 Get destination information
SP3-4 Get additional route information
Short range trip info
SP3-5 Get short trip info

Info in stations and hubs
SP3-6 Get Public Transport Timetables
TMIC interface
SP3-7 Get real time traffic information
SP3-8 Get unexpected trip events while on trip

Long-range trip info
SP3-9 Long-range trip info
Multimodal trip planning
SP3-10 Multimodal trip planning

Category 2: Route guidance
In-vehicle
SP3-11 Elderly friendly in-vehicle route guidance
SP3-12 Parking availability

Pedestrian
SP3-13 Be guided en route / trip (previously planned)
SP3-14 Bookmark a route
SP3-15 Look after me
SP3-16 Find current location
SP3-17 Get information on ways to reach POI types as pedestrian
SP3-18 Bookmark a POI
SP3-19 Disruption of service notification and re-planning
SP3-20 Dynamically map update

OASIS
UCs on autonomous mobility and smart workplaces applications

Category 3: Personal mobility
On-demand services
SP3-21 On demand DRT services
SP3-22 On demand special car rental services

Driver telematic support
SP3-23 Driver/passenger health assistant in critical conditions
SP3-24 Emergency call for road accidents
SP3-25 Driver/passenger health monitoring on demand

Driver comfort support
SP3-26 Elderly driver discomfort detection
SP3-27 Task dependent driving environment adaptation
SP3-28 Elderly driver stress detection

Tourism and leisure
SP3-29 Get tourist info on POI/event/trip in your city
SP3-30 Get tourist info on POI/event/trip to another city/country
SP3-31 Get/give evaluation on a POI/event/trip to your/another city/country
SP3-32 Be informed when a member in the contact list enters an Activity Space

Category 4: Smart workplaces
Smart workplaces
SP3-33 Connecting Bridge
SP3-34 Work Assistant" application
SP3-35 Advanced authentication mechanism

Telematic tools and technologies for flexi-work
SP3-36 Background Data Synchronization
SP3-37 On-the-fly Synchronization
SP3-38 Remote Control

Fig. 4. The OASIS UCs on autonomous mobility and smart workplaces

3.3 HCI and the OASIS Use Cases

The issue of HCI is involved in the majority of the defined use cases, both of sections 3.1 and 3.2. This was expected, as all UCs deal with the development of new systems, with innovative user interfaces, satisfying automatic self-adaptivity and personalisation concepts.

The need of appropriate HCI design is depicted in the presentation of a synthetic UC, combining the application areas of sections 3.1 and 3.2. The synthetic UC description is: Planning a trip (Fig. 5a), using route guidance, deciding to record a film on the DVD (Fig. 5b) while on trip (through the OASIS remote environmental control module), sharing the trip experience with a friend (OASIS social activities support;

Fig. 5c), and returning at home, using the nutritional advisor and health monitoring advice (Fig. 5d). This sequence of actions requires the use of a mobile device by the user, as shown below:
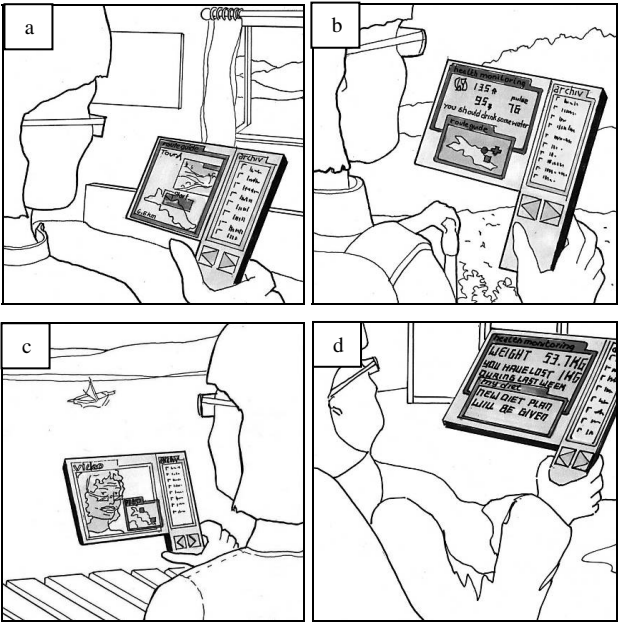

Fig. 5. A synthetic OASIS UC

The key device for the delivery of mobile services is the PDA, whereas other possible needed devices include smart PDA or smartphone, bus-stop information panel, etc. Their effective use will require several challenges to be considered beforehand. These are relisted below, along with some thoughts for consideration in OASIS:

• Challenge: Individual user needs and preferences

Personalisation of HCI should be performed automatically by the system, according to user type, profile (based on history if use, with the user being always the master of his/her profile), culture and context of use, but also progressively, following user actions (i.e. a user without car, now has also a car) and age-related deterioration characteristics (e.g. automatic adjustment of the size of the letters in the screen). Furthermore, cross-cultural factors are influencing human-computer interactions from different dimensions (perceptual, cognitive, and affective). Rather than cultural-specific appearance, a cultural-adaptive system should also adapt metaphors, navigation and interactions to the culture of target users, for better performance and higher satisfaction. Configurable and culture-adaptive interfaces are needed.

• Challenge: User navigation throughout the service chain.

Intelligent multimedia dialogues and high interaction level are absolutely needed, to allow the user to navigate easily from one service to another or within a service.

- Challenge: Device limitations.

Alternative HCI concepts must exist for some key services, to be able to be supported in "poorer" devices too (i.e. lacking vibration). Also external HCI modules (i.e. vibrating belt or seat belt) need to be available.

- Challenge: Services competing among them for users' attention or providing concurrently info or warnings by the same or different media.

Need for services hierarchy and HCI integration. Also, need for multi-sensual systems, to be able to handle multiple-warnings and support users with various problems in information retrieval channels.

4   Conclusions

The OASIS use cases (UC) and scenarios of use have been defined based upon literature review, on-site interviews, technological benchmarking and iterative consensus building among key stakeholders, already present in the OASIS Consortium and user group representatives.

As the use cases form an immediate reflection of user needs and relevant gaps in the area of services for the daily support of the elderly population definition of OASIS, they constitute the starting point of work for the definition of the user-computer interaction platform and properties, being the easy customisation and system reconfiguration (e.g. through assisted dialogues), personalisation to the individual need and preferences of the users, self-adaptivity of content presentation according to environmental constraints, devices restrictions, cultural characteristics, multi-services interconnection, etc.

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