

The OASIS Concept

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Abstract. OASIS is an Integrated Project with the aim to revolutionise the interoperability, quality, breadth and usability of services for all daily activities of the elderly, by developing and deploying innovative technological challenges, consisting of a new, open architecture and a hyper-ontological framework. A wide range of applications are integrated in the areas of independent living, socialization, autonomous mobility and smart workplaces. User friendliness and acceptability of OASIS services are a top priority of the project, ensured with a user-centered design approach and the development of interactive services.

Keywords: ontological framework, elderly users, independent living, autonomous mobility, smart workplaces.

1 Introduction to OASIS

OASIS is an Integrated Project that started in 2008. It is co-financed by the EC (7th FP) and encompasses 33 complementary partners (from 12 countries), addressing a very wide technological area (semantic web, knowledge representation, transport, tourism, health, domotics, UI design, e-Learning, e-Work, etc.), including leading industrial partners, multidisciplinary and strong research teams, including academic participation.

The project aims at an open and innovative reference architecture, based upon ontologies and semantic services, that will allow plug and play and cost-effective interconnection of existing and new services in all domains required for the independent and autonomous living of the elderly and their Quality of Life enhancement. Both the open reference architecture and the related tools will be made available as open source.

The OASIS System is open, modular, holistic, easy to use and standards abiding. It includes a set of novel tools for content/services connection and management, for user interfaces creation and adaptation and for service personalization and integration. Through this new Architecture, over 12 different types of services are connected with the OASIS System for the benefit of the elderly, covering user needs and wants in terms of Independent Living Applications, Autonomous Mobility and Smart Workplaces Applications. In detail, the following applications are foreseen within OASIS:

A. Independent Living Applications:

- nutritional advisor,
- activity coach,
- brain and skills trainers,
- social communities platform,
- health monitoring and environmental control.

B. Autonomous Mobility and Smart Workplaces Applications

- elderly-friendly transport information services,
- elderly-friendly route guidance,
- personal mobility services,
- mobile devices,
- biometric authentication interface and multimodal dialogue mitigation and other smart workplace applications.

Applications are all integrated as a unified, dynamic service batch, managed by the OASIS Service Centre and supporting all types of mobile devices (tablet PC, PDA, smartphone, automotive device, ITV, infokiosk, etc.) and all types of environments (living labs, sheltered homes, private homes, two car demonstrators, public transport, etc.) in 4 Pilot sites Europewide. As user friendliness and acceptability is a top priority for the project, a user-centered-design approach is followed along the service and application development.

2 The Relevant Need

Age and disability are strongly correlated: 15% of the EU population has a disability; 70% of them will be over 60 by 2020.

There exist two main trends in the 21 century. One is the rapid development of ICT, which has affected all areas of life of people and radically changed the way-people live and tackle many activities. People have entered into digital times. The other is the trend of aging population, which has attracted attention from government as well as business firms. Potential business opportunities exist exactly at the crossing point of these two trends.

The older population is growing at a considerably faster rate than that of the world's total population. In absolute terms, the number of older persons has tripled over the last 50 years and will more than triple again over the next 50-year period. In relative terms, the percentage of older persons is projected to more than double worldwide over the next half century, to expand by more than three times, to reach nearly 2 billion, in 2050.

This rapid expansion in the older population affects practically all regions of the world and is increasing. Currently, the annual growth of the older population (1.9%) is significantly higher than that of the total population (1.02%). In the near future, the difference between those two rates is expected to become even larger, as the baby boom generation starts ageing in many parts of the world, including Europe. By

2025-2030, projections indicate that the population over 60 will be growing 3.5 times as rapidly as the total population (2.8% compared to 0.8%). Even though the growth rate of the over 60s age group is expected to decline to 1.6% in 2045-2050, it will still be more than 3 times the growth rate of the total population (0.5%) by mid century (see Figure 1). Below, the needs of the elderly population for specific areas is presented, together with OASIS plans and objectives in order to overcome them (United Nations).

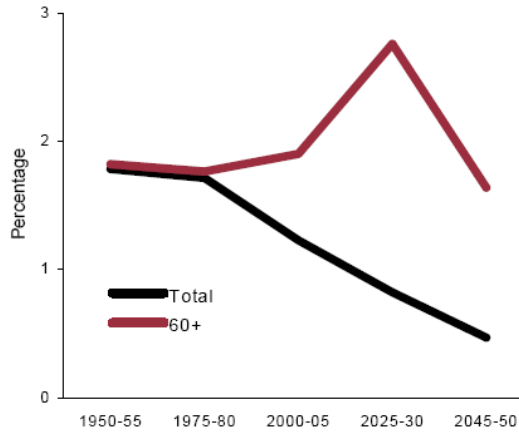


Fig. 1. Average annual growth rate of total population aged 60 or over, world, 1950-2050 (United Nations)

2.1 ICT and the Elderly

The profound, pervasive and enduring consequences of ageing population present enormous challenges as well as enormous opportunities for Information and Communication Technology. A typical example is the Internet that – according to many analysts – has become an enabler of social inclusion.

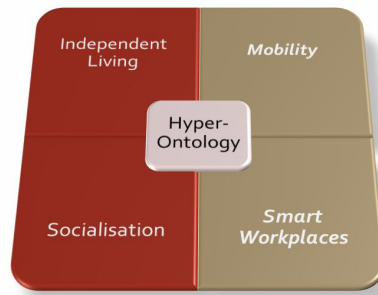
Social isolation is a common problem for senior people. Fortunately, the Internet offers new tools to address the problem. Internet users acknowledge that going on line is a good and convenient way to contact the outside world. Senior people can walk out of loneliness, through sending e-mails to family members and friends all over the world, chatting in forums to exchange feelings and ideas, etc. Indeed, many senior people are already benefiting from the Internet.

OASIS aims to utilise ICT and other key technologies in order to provide holistic services to the elderly to support their physical and psychological independence, stimulate their social or psychological engagement and foster their emotional well being. In doing so, OASIS thus addresses key areas of their activities encompassing: independent living and socialising, autonomous mobility, and flexible work-ability.

Table 1. Internet users in 2002 and 2005

Internet Users in 2002	18-29	30-49	50-64	65+
	%	%	%	%
Canada	86	80	62	23
Germany	81	62	33	9
US	80	78	56	20
UK	72	63	30	10
France	71	53	30	5
Poland	46	21	9	0
Russia	17	6	3	0

Internet Users in 2005	18-29	30-49	50-64	65+
	%	%	%	%
Canada	91	83	68	31
Germany	85	79	53	16
US	81	83	68	32
UK	89	84	67	24
France	92	66	52	12
Poland	70	44	22	4
Russia	32	18	3	1

**Fig. 2.** OASIS targeted domains

3 OASIS Technological Developments

The following developments have already started in the project, aiming to assist the elderly users:

- A new Architectural Framework, called “COF-Common Ontological Framework” or “OASIS hyper-ontology”, based upon the Common Algebraic Specification Language (CASL) of IFIP WG1.3 (Foundations of System Specification). The hyper-ontology is open, modular, holistic, easy-to-use and standards-abiding and allows the interoperability, seamless connectivity and sharing of content between not only single services but also competing ontologies of the same or different application domains.
- An Open Reference Architecture (also called ‘OASIS Platform’), composed by the COF and its support tools (Content Connector Module-CCM and other ontology management modules), both available as open source, that allow the automatic or semi-automatic connection of existing and emerging ontologies and services to the OASIS Architectural Framework.

- The OASIS System, composed of the new Open Reference Architecture, enriched by an AmI Framework (a multi-Agents platform) and the Interaction Platform (allowing automatic UI self-creation for new connected services and self adaptation to the device used, the context of use and the user needs and preferences).
- A wide range of connected applications (over 12 different service types), all integrated within the OASIS System, and interoperating in integrated scenarios and Use Cases, covering the needs of the elderly and their caregivers in terms of Independent Living, Socialisation, Autonomous Mobility and Smart Workplaces.
- A Pilots test-bed, consisting of 4 sites Europewide and all potential test environments per site: Living Labs for technical verification and iterative development, Sheltered Homes for assisted living and user communities related real-world applications and Independent Living, namely private homes, for real world applications.

Thus, the OASIS system consists of the reference architecture, the Ambient Intelligence Framework and the Interaction Platform.

System efficiency and user acceptance are expected to increase through the development of a self-learning and adapting system to interactions, effective computing principles, models of human behaviour and human activity recognition, the flexibility of new mobile paradigms and devices, ontologies for sharing of contextual information between different services and objects and 3D based multi-media interaction systems and virtual community technologies, with appropriate privacy and ethical safeguards.

4 OASIS Interaction Principle

To facilitate the development of interactive services, the project will develop an interaction prototyping tool that will enable designers and developers to base interaction, accessibility and self-adaptation (user and context oriented) design on the semantic models in the Hyper-Ontology.

This tool will facilitate the connection of application task models (i.e., services) with accessibility solutions and adaptivity. Specifically, it will enable interaction designers to: create rough interaction models; connect user activity to monitoring; identify transformations and inferences leading from monitored data to (updates in) the dynamic models; encapsulate preliminary adaptation logic and effects; specify how adaptations are effected in the interactive front-end. In more detail, this tool allows the following very innovative functionalities:

- a. Self-adaptation of interface to the specific device (device abstraction and device oriented customisation).
- b. Self-adaptation of interface, to include new or modified applications (application and adaptation logic).
- c. Self-adaptation of interface to the specific elderly needs, preferences and dynamically updated profile, according to his/her behaviour and services use pattern (user modelling and user oriented adaptability).
- d. Self-adaptation of interface to the context of use, such as home, car, street, bus, etc. (context modelling and context oriented adaptability).

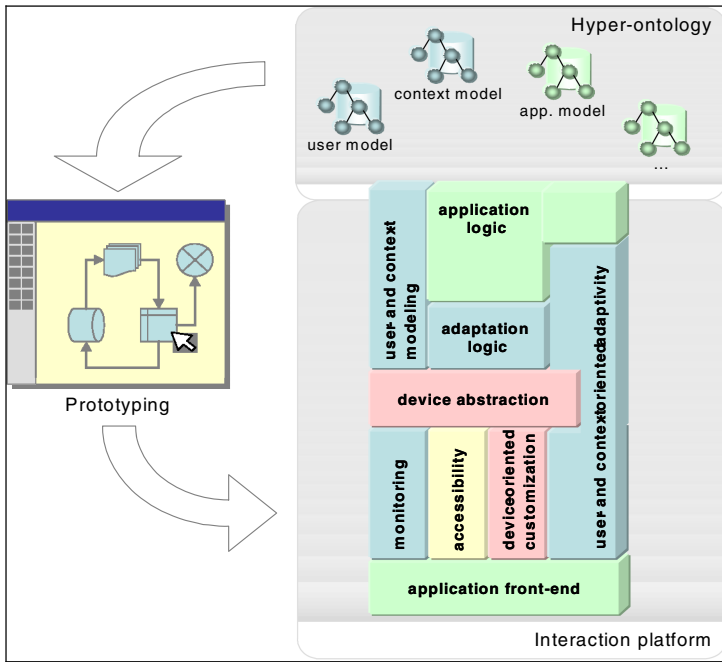


Fig. 3. Interaction platform of OASIS, to connect the hyper-ontology with the mobile devices

The output of the prototyping tool will be such as to facilitate further development of the interfaces, while preserving the possibility for full-cycle re-engineering of the modified output.

Also, an Ambient Intelligence (AMI) framework is developed, as key enabler of the project development platform, based upon a family of intelligent agents, to orchestrate, monitor, personalise and deliver the integrated services. The customization of devices according to own needs and preferences is facilitated by its AMI framework. Its architecture is shown below, where it can be clearly seen that the user personal AMI space relates directly to the user-computer interaction, through the various possible end-user devices supported by the OASIS platform.

Several sensors are being connected as part of the developed services, consisting of unobtrusive wireless acceleration sensor (for recognition of the type of movement if the elderly user, e.g. walking, sitting, climbing upstairs), physiological sensors (for accidents detection), wearable biometric and in-home positioning sensors (for health monitoring), ultrasound and radio-based localisation sensors (for in-door localisation), etc. The overall multisensorial platform architecture, showing their connection to OASIS hyperontology and its interface to the applications, is presented in the following figure.

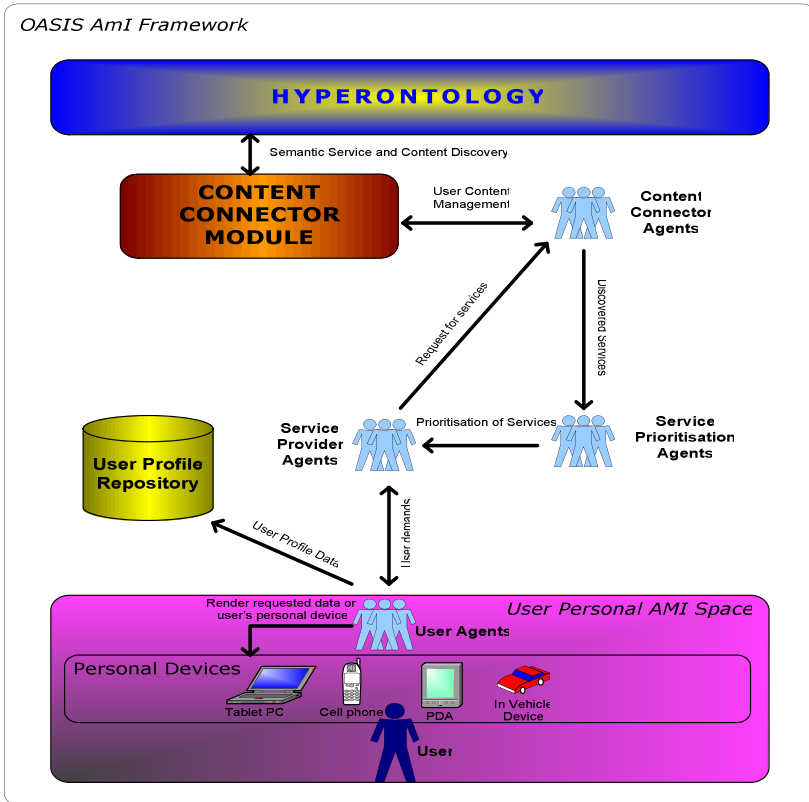


Fig. 4. OASIS AmI Framework

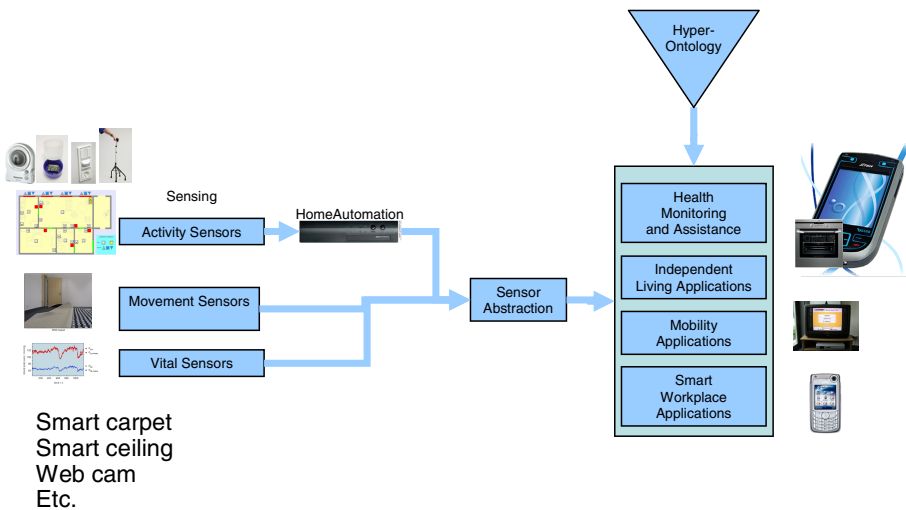


Fig. 5. OASIS multi-sensorial platform and its interface to applications

System efficiency and user acceptance are expected to increase through the development of a self-learning and adapting system to user interactions. Thus, among its goals, the following are directly relevant to the creation of an innovative and adaptive HCI concept for all types of users:

- To develop an intelligent interaction platform, to support the interaction between the user and the OASIS reference architecture, through self-adaptation of the interface layer to the type of device used (PC, tablet PC, PDA, smart phone, automotive device, infokiosk, ...), the specific service layout, the context of use (i.e. at home, in the car, ...) and the elderly user personal needs and preferences.
- To develop innovative multi-sensorial interface concepts, making use of visual, acoustic, haptic and even olfactoric elements and smart materials.
- To develop intelligent dialogues and interaction principles for user-system interaction seamless and concise adaptation according to the device, context of use and progressively changing user needs and preferences.

5 Conclusions

The objective of OASIS is the development of an innovative reference architecture ensuring a holistic approach to issues related to independent living and ageing. The System, which will be based on this innovative reference architecture, constitutes a complete system of sensors, content, services, devices and applications. Both the OASIS open architecture and the connected applications constitute a big step beyond the current state of the art, supporting seamless integration and plug-and-play operation of sensors, devices, sub-systems and integrated care services.

The user-centric approach of the OASIS applications, combined with their intuitive elderly-friendly design, minimises the intrusiveness of technology and offer users the opportunity to customise devices according to own needs and preferences. This customisation takes place through the user- and context- oriented adaptivity facilities of the OASIS framework and is facilitated by its AMI framework.

Eventually, the OASIS system is planned to be tested iteratively and thoroughly by hundreds of end users (in North, Central, South and East- Europe), their caregivers and other stakeholders, in order to optimize it and submit for standardization by the established OASIS world-wide Industrial Forum.

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