ODISEA: Active Environments for Intelligent Offices and Homes

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1. Introduction

The main goal of this project is the creation of a highly interactive environments based on multi-modal user interfaces (speech recognition, computer vision, etc.). These environments will be able not only to observe the users but also to participate in their everyday tasks. They can be implanted in, for instance, a household, an office, an industrial control room, or a navigation setting (driver assistants).
In this framework we will develop a series of agents and the corresponding integrating architecture that will allow to include cameras, microphones, and, in general, all kinds of sensors (smoke, water) in the "active" environment. All these, along with image processing mechanisms, gesture recognition, speech recognition, natural language processing, robust speech control and other similar technologies, will allow a natural and fluid interaction with the environment.
We shall also implement an intelligent room as the test laboratory for all these technologies. Such a room will be able to interact with its inhabitants through voice and gestures, will be context sensitive, and will be able to anticipate to events occurring within it. In the same manner we shall implement natural language interfaces in all project participants' offices so that the overall system would be tested under real conditions.

2. Prior Work

The concept of ubiquitous computing was initially defined by Mark Weiser in 1991 [1]. According to Weiser, both the ubiquity and the transparency of the system are the salient characteristics of ubiquitous computing.
Perhaps one of the earlier implementations of a ubiquitous system is the Olivetti *Active Badge* system [2]. One of the first applications of this technology was to locate a person quickly on a campus.

The Xerox *ParcTab* system [3] went one step further in augmenting the user with mobile computational power. A more recent extension to *Active Badge* system is the *Audio Aura* system, in which the users wear an active badge and wireless headphones [4]. A work more concentrated on embedding the devices is the *Things that Think* Project at the MIT Media Lab [5].

There are also other augmented reality research prototypes that require the user to wear some apparatus. This type of work has resulted in a new field of research entitled Wearable Computing.

In a similar vein, research on home automation has focused on hiding computational devices and providing transparent interaction to accommodate to non-technical users. An example of this sort of research is *The Neural Network House* [6]. Transparent interaction has also been explored in office environments, this is the case of *The Reactive Room* [7].

More recently, there is a lot of interest in having interfaces completely unencumbered and non-invasive. Computer vision and audition techniques are being extensively employed to provide ubiquitous systems with awareness about the users activities. So do the *Smarts Room* [8] and *KidsRoom* [9] systems from the MIT Media Lab.

Other leading projects are *Intelligent Room* [10] from the MIT AI Lab., and *Classroom 2000* [11] and *The Aware Home* [12] from the Future Computing Environments group of Georgia Tech.

3. The ODISEA project

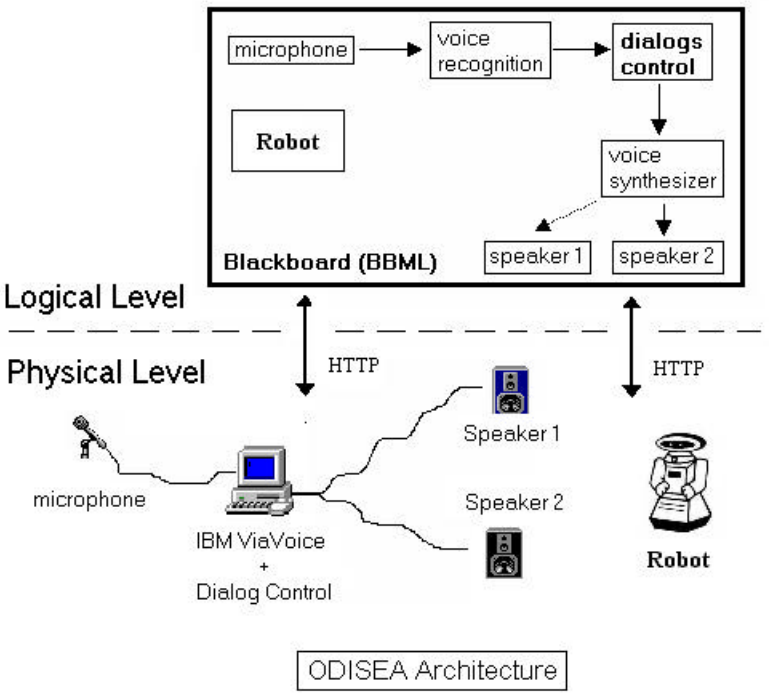
The goal of the ODISEA project is to create the infrastructure that will allow developing intelligent environments that will communicate with their inhabitants in a natural way. The intelligent room will be aware of its inhabitants and their current tasks and intentions and will show a reactive behaviour fulfilling all sorts of users requests, as well as a proactive behaviour, offering help spontaneously.

One of the focuses of the project is the development of a robust dialogue management system that will allow the user to interact and to control the environment making utterances in natural language.

Dialogue implementation will be based on various dialogue modules independent from each other, each dialogue module managing just a specific subject. Dialogues will be based on templates, in a way similar to Shank's scripts [13].

The dialogue manager will have to decide the dialogue subject in which the system is involved in each moment.

The second focal point of the project is the development of a software architecture that will allow the integration of heterogeneous agents in a comprehensive environment. Each agent will be able to use services from the others, through a centralised logical representation of the world: a blackboard.
The blackboard definition language will be XML and it will not only model the components of the intelligent environment but also the information flow among them. The communication protocol with the blackboard will be HTTP. Hence, the blackboard will be built around open protocols and data formats, and therefore it will be language and operating system neutral.



ODISEA Architecture

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