

Intelligent and Self-Adaptive Interface

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Abstract. The computer systems for the decision-making must provide in a synthetic and simple way the necessary elements to the decision-maker. That is why, it is indispensable to build Computer Human Interface (CHI) adapted to every user's perception as well as possible. The necessity to design the application data processing providing an intelligent and self-adaptive CHI seems to be therefore more and more necessary. An essential and necessary characteristic of this kind of CHI is the capacity to adjust to the environment to the user's behavior and to permit the addition of components without putting back in question the design of this one. In order to have this characteristic in an application, a modelling using intelligent agents seems to be well adapted because it permits to take into account the complexe interaction present in the CHI.

Keywords. multiagents systems, adaptive systems, computer human interface.

1 Introduction

During the last decade, the evolution of computer system has been encreased. This evolution is notably visible with the CHI. Whereas the first computer systems have a single online interface to interact with the user, now the computer applications are based on a graphic representation of the CHI (windows, dialog boxe, ...). This evolution of the CHI represents a transformation of the computer systems that was important because it allows users to use computers even if they are not specialists. It also permits to reduce the time of training of these users.

The use of computer systems is become widespread these last years. Nevertheless their use remains many difficulties for people who has not an experience in the computer domain. Moreover, every utilization of a system is making itself in a different way according to every person. It would be appropriated therefore to have a different CHI foreach category of users. The solution that we keep to

answer to these new needs is the self-adaptable CHI conception based on a modelling by agents[6]. The principle of this new kind of CHI certainly constitutes the next important evolution of the Computer-Human Interactions[1][3].

The CHI should lean henceforth on a separation between the domain objects and objects of interface (cf. fig. 1). To make this, we use the MVC model of SmallTalk [2] describes in [1]. The idea is to develop independent one user-interface of the domain. It must be especially possible to modify in part or in totality the CHI without changing the actions of the underlying application. In the setting of self-adaptive and intelligent CHI, these modifications takes place to the asks of the user or in an automatic way.

In this article, we propose a model of self-adaptive CHI based on a modelling by agents. In the section 2, we presents the reasons that brought us to design an intelligent CHI. Then, we presents in the section 3, the modelling by agents of an intelligent CHI that we have achieved. In the section 4, we present the application of these works through two systems and the implementation choices we have done. We conclude this article by the possibility to spread these works and to take them into account in industrial applications.

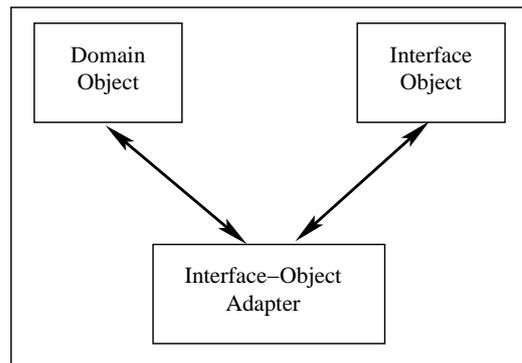


Fig. 1. A model to design CHI

2 Why an intelligent CHI?

We have begun in the introduction of this article to give some reasons of the necessary to design intelligent and self-adaptive CHI. A first reason resides in the constation of the inefficiency of the classical CHI facing the new needs of applications that must allow users to have the best possible comprehension of the computer system. A good design of a CHI must permit to get the CHI answering to the specific needs of each users. For this reason a CHI which would adjusts itself to the user's behavior seems us adequate.

Besides, the maintenance of the classical CHI require programmer's intervention to make again entirely the design of these CHI. In order to reduce the cost of this maintenance, the design of interfaces must be entirely determined by the user and must have an important capacity of evolution therefore that the classical CHI, seem to be indispensable. The realization of this kind of interface can be done by means of an adaptive CHI based on a modularity of its components. Indeed, it must be possible to modify the interface by addition, remove or modification of components without to change the heart of the computer system.

The necessity to design applications data processing providing an intelligent and self-adaptive CHI seems to be therefore a solution for future applications. For us, the complexity of interactions inside an intelligent CHI justifies the use of multi-agent systems based on the notion of light agents[6]. We must take into account interactions between application and user and the modification of the CHI induced by the evolution of the data processing.

So the modelisation of intelligent and self-adaptive CHI is done in the setting of our work by an agent modelling.

3 A modelization by agents

We achieve in this section, the modelling of an intelligent CHI that can be adjusted automatically to every user's behavior by the means of different organizations of agents. These organizations can be gathered in two important categories:

- User agents: they are about the organization of agents allowing each user to personalize its CHI directly and of interaction with to the intelligent agent means with this one.
- Interfacing agents: they manage the different elements of the interfacing in order to answer to the contextual needs of the application. They are not directly in relation with the user.

3.1 User agents

The personalization of the CHI by agents permits to introduce a bigger suppleness of the CHI. Indeed, it is possible for users to make calls to agents that will permit to personalize itself its interface in order to answer to his needs. It concerns the designing of CHI that are entirely modifiable without the user have to make considerable and expensive efforts and lost time.

The possibility to increase the number of agents and to include some of new in order to arrange new way of interaction with the data processing systems constitutes one of the essential features that brings us to have recourse to an organization of agents. Agents users are the reactive agents that have very little knowledge but can make call to interfacing agents that we describe in the next paragraph.

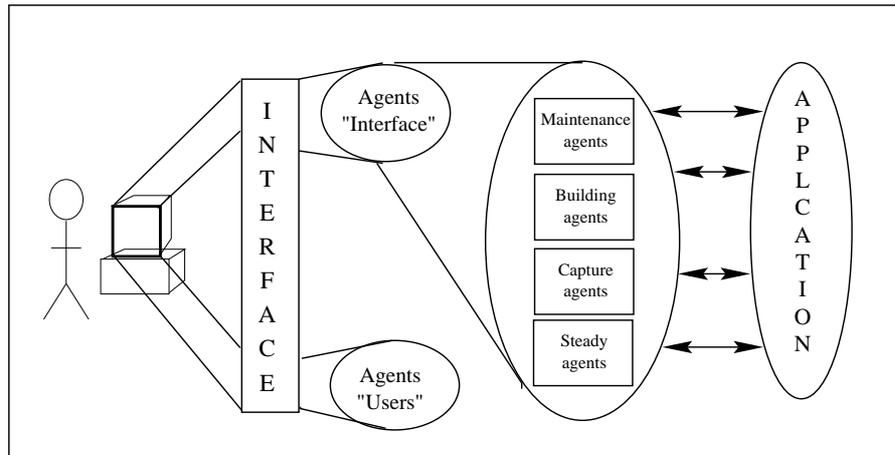


Fig. 2. Modelling an intelligent CHI by multi-agent systems

3.2 Interfacing agents

Interfacing agents, as we have begin to describe, in the beginning of this section, have to manage the whole interface and notably the user's modelling. We distinguish four categories of interfacing agents that we are going to describe in the following of this paragraph.

3.2.1 Agents of maintenance of the interface This first organization of agents is characterized by agents of the reactive type. Their role limits itself to the exploitation and the organization of the different components of interfacing to manage the CHI. They are able to add, to modify, or to suppress components within the CHI. New components can appear within the system by composition of existing components. All components are managed by an agent of maintenance. The creation of a new component will be make itself by creation of a new agent whose structure will be predefined by the way of a generic maintenance agent architecture. Agents of maintenance can be brought to collaborate with user agents and agents of construction of the interface that we describe in the next paragraph.

3.2.2 Agents of construction They are cognitive agents that have a knowledge of the domain of the application permitting them to construct a CHI that corresponds to the needs of representation of this one. They manage the representative elements of results of the application but as the structuring of the different elements permitting the Computer Human Interactions. They are charged in a global way of the graphic interpretation of the state of the system and the subjective representation of this state. Their interaction is essentially present within

their own organization but it also exists interactions with the organization of agents and the organization of interfacing agents.

3.2.3 Agents of capture These agents that we qualify agents of capture takes into account demands of users destined to the computer system. That is why they capture elements transmitted by the way of the interface to make elements that are comprehensible by the computer system. These agents are said to be cognitive because they have the knowledge permitting them to do the previously described transformation. This knowledge is acquired by the system at the moment of its conception by the definition of an ontology.

3.2.4 Agents of watching evolution of the situation These agents that are able to present the follow-up of the application to the user permit to alarm the user of the abrupt changes of evolution of the situation. It is necessary to remind that we stand for our works in the setting of applications conceived for help to the decision. For example, in an application where there is exists a watching of a temperature curve, it is sometimes necessary to alarm the user at the time of the overtaking of a threshold. The organization of agents of follow-up of the situation permits from a knowledge acquired to conception of the system to construct an analysis of the evolution of the situation.

4 Implementation and applications

The application of the model previously described is doing itself within two applications: the first concerns the design of an aided based application for electronic market management; the second concerns the design of an application for the survey of industrial area with high technological risk. We begin in this section by the presentation of our choices of implementation that we have done for these two applications.

4.1 Implementation choices

The conception of these two applications requires a distributed architecture because it is about multi-user applications. These user interactions through different interfaces that are connected to a computer system are based on a Corba architecture. The platform of multiagent system development named MadKit [5] has been chosen for its suppleness of utilization and its portability on different operating systems[4]. This platform has been developed in the LIRMN laboratory of the university of Montpellier by Olivier Gutknecht with the Java language that we will use therefore.

4.2 Application to the electronic trade management

In the setting of application of aid to the trade by computer system slant, users must be able to arrange a system permitting them to get information in order to

inform them to take their decision, either to sell or to buy a product. In the same way, the CHI must permit them to make transactions of purchase and sales. One other functionality of this CHI is to be able to warn the user when the situation undergoes a meaningful change that can interest the user. To take into account this last point, it is necessary to arrange the model of the user and its habits.

4.3 Application to the survey of industrial site

The industrial site implantation with high technological risks (chemical factories and petrol factories) in urban area gives back necessary the installation of a network of alert sirens for the confining of populations. The trigerring off of these sirens must take place following the occurrence of a serious incident. In order to permit this detection, it is necessary to design a computer system permitting the dangerous industrial site survey. This system should give account of the situation by the of CHI. This CHI should allow the operator to fear the gravity of the situation quickly. It must be able to present and to bring to the fore the essential elements of a situation. This application will be design in the setting of a project having for objective the installation of a sirens network for the city of the Havre in France.

5 Conclusion and perspectives

In this article, we have presented the design of an intelligent and self-adaptive CHI based on the agent paradigm. These works are done in a larger setting of the conception of decision support systems. We are currently designing these applications. Our future works on the CHI will hold into account of a models user endowed of capacities of training that permit him a bigger adequacy with the personality and the user's habits.

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