E-RETAIL: INTERACTION OF INTELLIGENT SELLING SPACE WITH PERSONAL SELLING ASSISTANT

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Abstract: With the availability of nomadic computing, and its new interaction user devices connected through wireless networks, it is obvious that the traditional way of delivering commerce will evolve towards "pervasive-commerce". This paper presents our approach based on Intelligent Selling Space to augment interaction in store department, and with the seller equipped with a personal assistant. For that purpose, we defined interaction patterns and a generic infrastructure based on OSGi and UPnP. Our approach is currently evaluated in a hypermarket.

1 INTRODUCTION

With the rapid dissemination and uses of mobile wireless devices, there is an opportunity to enlarge, or to modify, the scope and the nature of the traditional retail industries, whatever the format of the selling places. This means that mobile personal devices can be useful in both situations: physical place in the retail locations, and virtual place for the e-commerce. We focus our attention on the possible augmentation of the interactivity and intelligence -- for example by recognizing the client and personalizing the contents and elements of the user interface -- of the traditional apparatus used for the retail place: shelves, carts, store windows, apparels, etc.

It appears, both in the research field, and in the practical uses in the retail industries, that new systems (setting of different electronics components embedded in furniture) have been designed and experimented, using the potential of interaction with different format of displays, and different modes of interaction such as tactile one or user movement detection by video camera… This will be summarized into the section 2 with some views of the future of the commerce as emergence of the "pervasive-commerce" in the same way of evolution of the Information and Communication Technologies toward pervasive computing or communication (Satyanaryanan, 2001).

Our attempt is to develop a more generic approach of these systems that will be called "Intelligent Selling Spaces", or ISS, defined and illustrated in the section 3.

We put attention of the extensibility of these systems and their openness to interactions with mobile devices carried by both the client and the seller. Persons who are situated into the immediate vicinity of the ISS are considered. The user's mobile devices, PDA or Smartphone, are loaded with some software applications or widgets that specialize them as Personal Selling (or Shopping) Assistant, a PSA, and will be presented into the section 4.

We have selected two mains uses of the potential interaction of these PSA with the proximate ISS: First the PSA is used by the seller, who is in her/his retail department, as a remote control device to manage, update, and configure the ISS; Second the ISS is derived to augment the capacity of the PSA in order to provided, to the sellers and customers, more interaction capacities such as large displaying of the information… For that purpose we have identified several patterns of interactions, developed several typical scenarios of used in conjunction with some partners of the retail-industries. This has led us to design and prototype the PSA as a dynamic extensible personal user device (see section 5). This is the main focus of our paper.

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2 WHAT IS E-RETAIL?

2.1 Evolution of the Information and Communication Technologies for the Commerce

At the first look it seems that the traditional retail industries are not heavily impacted by the ICTs in their relationships with the customers. But in fact the attentive observation of the different retail places shown us that it is not the whole picture, and there is more and more presence of the ICTs in direct interaction with the customer, with a large diffusion of electronics displays of different formats. In fact the diffusion of the ICTs into the future retail places is going more and more pervasive…

Our analysis is that, first the development of all these systems is done mostly in ad hoc approaches, and second that this evolution must be coordinated with the e-commerce mode, which the same large companies often rapidly develop at the same time. The figure 1 gives an overview of the potential intersection between three major trends: e-retail, mobile communications and e-commerce. Our focus is on the part we have called Intelligent Selling Spaces, ISS, which will be located into a shop or a hypermarket and provided a dedicated functions in closed relation with the type of goods or products it helps to commercialise.

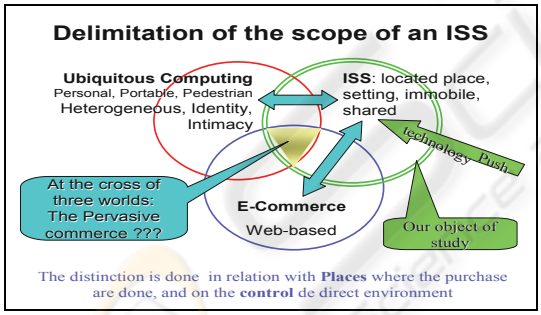

Figure 1: intersection of three domains and our object of studies.

2.2 Examples of Intelligent Selling Places

In the research field there are already several projects which have explored the design and uses of new computerised systems for e-retail. Very frequently they investigated also the potential of Radio Frequency IDentification tags attached to individual product (Konomi, Roussos, 2007) in order to read information rapidly and to identify exactly the product, in a more easy interaction that with the traditional barcode. From the scientific literature we can see proposals about intelligent shelves (Wasinger, Wahlster, 2006) smart carts (Kouroithanassis, Roussos, 2006), intelligent advertising displays, etc.

In some case a retail enterprise want to provide a more integrated show-case of these new technologies, both to learn how it is used on a larger basis, and also to give a good image of them. From our personal investigations in some of these new places, it seems that it is mostly technology push, and that, at this stage, there is no real or rich interaction with the mobile devices carried by the customers.

3 SOFTWARE ARCHITECTURE OF AN ISS: OVERVIEW

From the previous exploratory prototypes and study of the similar systems, we have derived a generic software architecture organized around a dedicated middleware to support Human-Computer Interaction in different modalities, including speech recognition and speech synthesis. It reuses our previous work about multi-channel and multimodal intermediations between a mobile personal user device and a collection of e-services (Chevrin et al, 2006). However the case of an ISS is simpler here because the number of services provided is small (specialized local functionalities), and the numbers of specific devices used in the interaction with the customer is, for a particular ISS, relatively small. We can consider that the ISS is relatively autonomous, required few connections with the information system of the shop, and can be easily described in a small ontology as a micro-world. So dynamic discovering of its services will be easier than in most of the Ubiquitous Computing projects, e.g. Smart Homes.

Our generic software architecture must take into account the modularity of the ISS (adjunction or suppression of some interactive elements, needs for adaptation to a particular retail company) and its openness to the PSA described into the next section. The figure 2 gives an overview of the software architecture.

An ISS is built by assembling of services UPnP (Universal Plug and Play) into an OSGi (Open Services Gateway initiatives) (OSGi, 2007) gateway:

UPnP is a wired IP protocol allowing the creation of spontaneous networks of devices (TV sets, HVAC, light control …) and control points

(PDA, Smartphone, touch panels …). UPnP enables the live detection of devices and the use of their services by the control points.

OSGi framework allows to deploy and redeploy Java-based plug-in applications (bundles) offering services (Donsez, 2007).

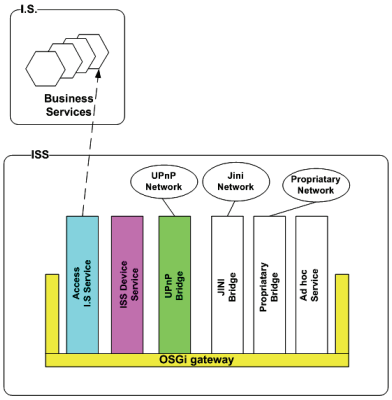

Figure 2: an overview of an ISS software architecture.

4 PERSONNAL SELLING (OR SHOPPING) ASSISTANT: PSA

4.1 The Functions of a PSA

Our focus is mainly on the support of the sellers in the context of an e-retail environment during all the phase of a buying activity by the customer: before-sale (research and selection of products or services by the customer), helps during the experience of the selected products (for example fitting a trouser), and helps during the customer decision, payment phase, after-sale…

It means that there are good parallels between the Personal Selling Assistant owned by the sellers, and a Personal Shopping Assistant which is carried by the customer inside the e-retail places. The software for the second one can reuse several functions provided to the first one. But there are also differences between the two kinds of PSA because:

- The customer PSA needs more context-aware adaptation of the interaction;
- The seller PSA hardware and basic OS platform are well known at the design time, stable and standardized for a known network of shops;
- The customer PSA is more heterogeneous and known only at run-time. This joins all the work and proposals about context-aware computing and dynamic adaptation of the user interface to the specificity of the particular mobile devices: plasticity of the interface (Chevrin et al, 2006).

The Personal Selling Assistant is often extended with some hardware and software elements in order to read optically barcode, or RFID Tags. Several dedicated functions are added for the management of the store (or of the seller department or section) as example requiring stocks for a particular product, prices and margins…

4.2 Advanced Personal Selling Assistant as a Coach or Instructor

In order to improve the efficiency of the sellers and to help them in their jobs, the PSA can provide more advanced functions. There are specific needs for knowledge accesses and exchanges, about the products or services sold or about the better selling process, and also needs for contribution to the knowledge base enrichment in the framework of community of practices. The use of a synthetic vocal output for the PSA, through a headphone, could even give the possibility to provide personalised coaching to the seller, in real time in front of the customer. It is also the same for the potential of a multimodal interface using voice in input, for example with the VoiceXML standard, which we have developed in the framework of e-commerce or design of digital coaching.

5 INTERACTION OF ISS AND PSA

5.1 Patterns of Interactions and Scenarios of Use

From our previous case-studies and from the state of the art in the e-retail domain, we have identified several patterns of interaction between an ISS and several PSA, which correspond to a large variety of use-scenarios. These patterns are enumerated here from the ISS view:

- Direct interaction with a customer without a personal mobile device;
- Collaborative interaction with the customer equipped with the personal mobile device able to support Bluetooth of Wifi local connections;
- Direct interaction with the seller without mobile device (setting request for information);
- Collaborative interaction of the seller, equipped with his/her PSA, potentially the ISS is seen as an extension of the PSA or is

supervised by PSA, used as a remote control device;

- Collaboration of the seller and customer collocated near an ISS. The different presentation devices of the ISS can support a shared focus, giving more than 5 different patterns depending of who owns a PSA and of the situation about data sharing and collaboration.

The problem about the nature and security of the wireless networks must be also addressed seriously, especially if the ISS are located into a large hypermarket. The main idea is to keep at the minimum the needs of connection and bandwidth with the global information system, used just for accessing some back-office information, and that ISS are relatively autonomous. This is straightforward with the core principles of pervasive computing. For the links with the global information systems, secured Wifi networks are used. Same, the seller's PSA can access directly the global information system, in any places of the store, by Wifi, and his/her PSA is protected, for example, by a biometric access control.

The PSA is personal and carried some information about the identity of the seller and profiles information. This means that we can consider that, for the seller, his/her PSA can simultaneously communicate with the global information system and the ISS. The PSA is then seen as a potential gateway between the two systems, supervised by the seller.

5.2 PSA as an Extensible User Device

5.2.1 The Extensions for Improved Interaction with the PSA

The figure 3 gives an overview of the software and networks architecture for the use of some ISS capabilities in order to augment the potential of a PSA for interaction. It must be noted that we include in this schema the extensions which are provided by the Personal Area Network such as the support of a Bluetooth auricle or others devices.

The figure 3 gives the flow of information and controls only for output extension of the PSA, both visual and sound. One criterion to select a destination of particular information, for example elements of an XML document, depends of its privacy or not. If it is only for the seller the information (e.g. product margins) is displayed only on seller PSA, or render by voice on his/her auricle. At the opposite if the information is public (e.g. characteristics of some products) and must be shared by the seller and the customer(s), it is displayed on the large display captured from the ISS, or render on its the acoustical channel, and possibly duplicated on the PSA depending of the nature of the information (for example size an resolution of an image). The next section will give more precision on this aspect in the framework of a particular prototype.

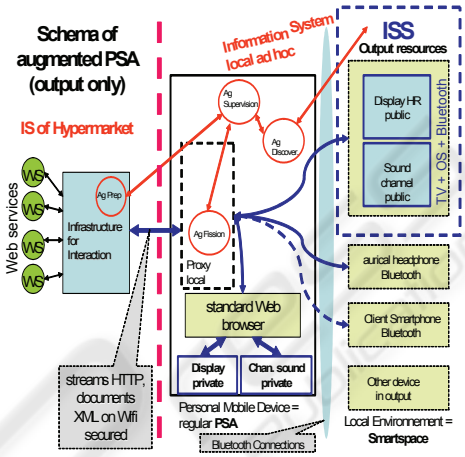

Figure 3: an overview of the flows of information for the collaboration of the PSA with the ISS and other personal mobile devices.

5.2.2 The PSA as a Context-Aware Mediator

Two principal mechanisms are used for the routing or mediation, done mostly inside the PSA, of information elements coded into XML messages: the fission mechanism directed toward the different outputs, and the fusion mechanism which combine elements of information going from different input devices. This later is required in order to support true multimodal interactions with the users. Of course the idea, in the context of multi-devices interactions, to use fission (Han et al, 2000) and fusion (Flippo et al, 2003), is not new. However we improve the propositions in four ways:

First:

These two transformations can be context-aware, taking into account profiles and choices of the PSA owners. This will be possible through use of a dedicated scripting language for small mobile device such as proposed by (Korpikää et al, 2006), and at the run-time some decisions can be still under the control of the PSA user, for example about adjunction of a new extension;

Second:

These routing functions and their supervision are distributed between the mobile device (PDA or Smartphone) which plays the major role, and the ISS which offers a well known service interface. This

schema leaves more flexibility in the design of the global information system accesses, because the relationship is at a more abstract level, for example with the tagging of XML elements as public or private, and it is more scalable.

Third:

The discovering of new capabilities is done dynamically; either in input or in output enables extension of the PSA. This means that it allows the change of the forms or even the mode (multimodality) of the user interface and interaction, during a transaction with the global information system. It is done if it has sense for the present interaction, and if the user accepts this extension. For Fission is not too difficult if the "agent" in charge of preparing the information document in the global information is sufficiently intelligent to react to this new composition, i.e to change at a fly the document transformation policies done with XSL-T. For the fusion, it is more difficult because the shift from a mono-modal interaction to a multimodal one, in the context of a continuing transaction, must keep the coherence of the user dialogue. To do that, we are working on the design of the interface of the PSA and the underlying software layers in a Model-Driven Engineering approach, where the models of the human contextual tasks are used as run time for verifying the opportunity of changes for extensions at right moment.

Fourth:

In some cases it is possible to use, by the global information system, the geolocalisation of the PSA (of sellers or customers) because they interact locally with a precise ISS, where its location, inside the hypermarket or the commercial mall is well known and stable. This allows the global information system to push information to the sellers, or even customers, that are in accordance with this place.

5.2.3 Distribution of the Document Processing

In the figure 3, there are three tiers which are involved into the processing of information documents: the global information system, the PSA and the ISS. Our architecture is based on a clear separation about the role of each tier:

- The global information system is composed first of all the services which can be of interest for the support of the sellers and shop managers or for the operation of the ISSs. For the mediation with the inner e-services which provide abstract forms of documents in XML, we reuse and adapt a specific middleware developed for multichannel and multimodal e-commerce (Chevrin, 2006) based on a Multi-Agent System.
- The PSA act as a mediator between the global information system and the ISS. It doesn't exclude some direct links from this one to the global system. The choice of using the mobile computer embedded in the PSA is justified first from security reasons, because the PSA is controlled by an employee of the shop, in presence of the ISS.
- The ISS is the third tier. It is well known since the design time: kind of ISS, its services interfaces, and its composition. The dynamic discovering of possible functions for the extension of the PSA is less difficult than the cases of a lot of projects about ubiquitous computing because it a relatively small world and stable during the commercial transactions.

5.3 A Case-study: used of an ISS as a Single Display Groupware

5.3.1 Scenario for First Deployment

The scenario is as follow: At anytime, from anywhere in the hypermarket, the seller is able to reach with his/her PSA, the different learning resources to enhance his/her technical and business tools available in the personal management system. The seller access the corporate information system to manage the different products of his store department (e.g. stock). During the selling activity, the seller has a direct access to all the products information. By this way, she/he can quickly and accurately answer to the customer.

To enhance the understanding of the customer, the pattern of collaboration can be used. The seller will augment his/her PSA with the ISS. He/She will gain access to a large LCD screen to expose some of the information, like technical features. By this way is it possible for the customer to compare more easily different products or to understand more deeply some technical aspects of the product.

5.3.2 Implementation

For our first prototype, the PSA is based on an Ultra Mobile PC (UMPC). In our gateway OSGi, we plug an UPnP proxy to control the LCD screen. In this proxy are implemented services supervising the PSA augmentation. A control point allows the seller to access these services in the PSA. Figure 4 illustrates that with the augmentation of the PSA.

Another OSGi service has the responsibility to control the data fission between the PSA and the LCD screen. This service is based on a XML description file which defines rights for each type of user.

Figure 4: A PSA extended with a LCD screen.

5.3.3 Evaluation

The prototype is currently under test for five months into a real hypermarket (digital photography department). From a technical point of view, we want to test the communication infrastructure and among others the latency and the information flow.

The prototype is also evaluated for its usability and social acceptance with respect to the work situations.But the main point of the evaluation is to study the collaboration patterns in order to improve their efficiency. How the seller and the customer interact through the system? Is the ISS really good to enhance the service offered to the customer? Is the selling activity more efficient?

To quantify the evaluation, we are looking at non-technical aspect, like the number of information or knowledge resources used (is the use of mobile device directly in the working place allows to pass more time on knowledge acquisition?) and the different characteristics of the selling (more selling? more or less time with the customer?)

6 CONCLUSIONS

In this article we present the concept of Intelligent Selling Space to enhance collaboration between seller and customer. For that, we repose on mobile devices and more especially on a Personal Selling Assistant which is used as a remote control of the micro-world constituted by the ISS.

In order to validate our approach, we are conducting an evaluation in a real hypermarket. In the meantime, we are designing and developing new services to enhance the ISS and to test more deeply the different patterns of interactions.

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