Personalized Services Oriented towards Commercial Establishments

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Abstract. This paper presents the platform "***PlaSerEs***", whose main objective is to provide information about the products y/o services offered by commercial establishments to their clients in a personalized way. This platform is structured in four layers: *i)* the adaptation layer, composed of four modules: the one of the context, the one of the access device, the one of the user and the one of the wireless connection. The latter is one of the main contributions of this work. *ii)* The general services layer, *iii)* the personalized services layer and *iv)* the application layer. In order to validate and to evaluate how "***PlaSerEs***" works, we developed a functional prototype for a restaurant.

Keywords: Personalization, Mobile Applications, Nomadic Users.

1 Introduction

When a nomadic user[1] accesses different *Information Sources* (*IS*) through his/her *Mobile Device* (*MD*), the information, which is displayed, does not take into account his/her needs, his/her characteristics, his/her preferences nor the characteristics of the context of use[2] [10][11]. Traditionally, the obtained results correspond to generalized information. Any user, without considering who or where he/she is, upon executing a query, he/she will obtain the same results and, additionally, it would not be optimized the fact that the systems can provide the information without an exhaustive and constant intervention of the user [4]. The act of guaranteeing to a nomadic user the access to several *IS* through *MD* [13], and the adaptation of the information as much his/her profile as his/her context of use[14] [9] are two problems actually reason of research which are not solved together [12]. Nomadic users who access several *IS* can obtain like answers to their different queries a great volume of information that is not always relevant and, sometimes, it is not supported by his/her *MD*.

When a nomadic user wants to request the different services and/or products provided by commercial establishments, these establishments provide them through generalized portfolios and catalogues for any public. The information resulting of

[1] Nomadic users are those who constantly change their location. It is important to note that conditions of information access and the request of services/products by nomadic users have changed, for example, the access through *MD*, the relevance of user's preferences, contextual characteristics, *etc*.

[2] For this paper, the terms "*context of use*" and "*context*" are used like synonym.

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these queries is provided without considering the needs of each one of their clients. Also, their publicity is done through announcements in massive means of communication or using posters inside the establishments, trying to maintain or to attract to their clients only with good prices and good products without offering more additional services fit to the user's characteristics [6].

Actually, some establishments have done efforts in pleasing to their clients, giving them products and services "*custom-made*". According to Jeff Bezos, founder and executive in chief of *Amazon.com*, such establishment wants to give to the virtual business, the personal touch that the business without technology had. In this way, a completely different and personalized page is presented. This page considers as much the preferences and the previous purchases, as data provided by the client at the moment of registering at the system. Bezos affirms: "*If we want to have 20 million customers, then we want to have 20 million' stores*"".

Considering the actual situation that we have exposed, we found a very valuable opportunity in the fact of offering to the commercial establishments, certain services that allow to the establishments to provide to their clients adapted information according to their preferences, their *MD* and their context. The interest of this paper focuses on helping to commercial establishments to the fast and better attention to their clients. Among the awaited characteristics by the clients in order to make indeed the tests in nomadic environments, are: *i)* clients equipped with *MD;* these *MD* must be equipped with some kind of wireless connection. *ii)* The user's expectative as far as the quality in service must be high.

This paper is organized in the following way: section 2 presents "***PlaSerEs***", platform which provides personalized services to clients of commercial establishments, main contribution of this work. Section 3 shows an application of "***PlaSerEs***" in the real world. We developed a prototype aimed at a restaurant. In section 4, we analyze some related works. In section 5, we conclude and present some perspectives of this work.

2 PlaSerEs

PlaSerEs (acronym of ***Pla****taforma de* ***Ser****vicios personalizados para* ***Est****ablecimientos Comerciales*, ***Pla****tform of Personalized* ***Ser****vices for Commercial* ***Es****tablishments*, see Fig. 1) allows to take into account different aspects of the user, his/her access device and his/her context in order to display adapted information when he/she requests certain services to commercial establishments. This section describes in detail each component of this platform. From the need of adaptation present in the actual systems, the concept of a model which has diverse aspects arises, specially, for adaptation oriented to the content, to the presentation and to the connection. This ***adaptation model*** takes into account: *i)* The content, based on a user profile and a context profile, *ii)* the presentation of the information using a *MD* profile and *iii)* the connection of both, the establishment and the *MD*.

In ***PlaSerEs***, the ***content module*** is composed of the user profile model and that of the context. The *user profile model* adapted from work of Carrillo *et al.* [4] describes the user preferences with regard to four main aspects: *i) activity preferences* which correspond to the user characteristics with regard to activities executed by user in the

system and the way in which he/she executes them. These activities are registered in a historical file which is used in order to determine possible user behaviors. Additionally, the user preferences are considered. These preferences are related to the specific application, for example, culinary preferences if the application is for a restaurant. Finally, it is necessary to specify his/her work in order to determine which information can be relevant. *ii)* The *basic user data* such as the name, gender, age, birth place and residence place are used for personalizing the content of the information which will be given as result of each query. Depending for example of the gender, different products or services are offered. *iii)* Additionally, we consider the *result preferences* and the *display preferences* which correspond to that; that the user wants to see displayed on his/her *MD*, specially, making reference to the display format, the multimedia data which prefers (*e.g.*, images, videos), all this evaluated considering his/her basic data and the characteristics of his/her *MD* profile. The remainder of information about the way of representation and the *MD* information is contained in the *MD* profile. *iv)* Finally, we have environmental and socio-cultural constraints which limit the abstraction of the user to certain conditions of the context. For example, if he/she is in the cinema, his/her behaviors (and preferences) are different than those he/she would have if he/she were in a soccer stadium with his/her friends. This information is obtained from the context profile explained below in this section. In Fig. 2a, we present the components of the user profile and its relations with other components of the adaptation model.

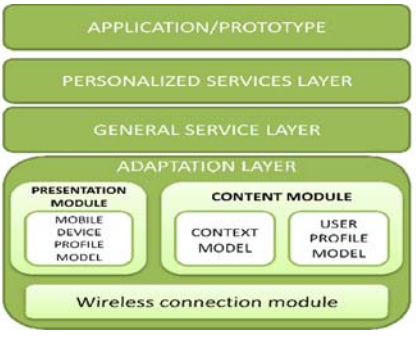

Fig. 1. Architecture of the platform "***PlaSerEs***"

The ***context model*** proposed by Kirsch-Pinheiro *et al.* [8] describes five dimensions: *i) What?*: are the services which can be presented in this place and at this moment. It depends on the information provided by the *IS* to which user is connected. *ii) When?*: establishes the temporal constraints that the application has. User can determine in which moment to execute certain activities. *iii) Who?*: determines to whom belongs to the profile relating it with the user profile and in this way, to determine the characteristics which can influence in the adaptation of the information. The other data of this profile are used for describing the context that the system has at the moment of the query. What day is today?, What time is it?, What is the actual

weather?, What is the season? And, What is the kind of establishment where the user is located? Fig. 2b shows the components of the context model and its relations with the other components of the adaptation model of the superior layers of ***PlaSerEs***.

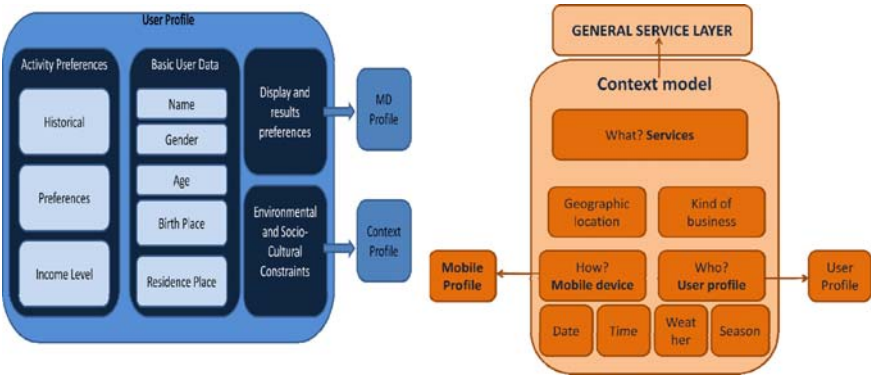

Fig. 2. (a) User profile Model. (b) Context profile Model.

The ***presentation module*** has as objective to consider the characteristics for taking into account, in order to display the information on the *MD*; it is composed of the *MD* profile model and it is defined using the extensions of ***CC/PP*** (acronym of *Composite Capabilities/Preferences Profile*) presented by Indulska [7]. The great advantage provided by this module is the possibility of knowing when to limit or to expand, according to its case, the quantity of information and the way in which it is given, being useful to the maximum the *MD* capabilities and, at the same time, do not overload it. Such overload can occur, for example, when users receive very large sized messages. The first that is taken into account is the information which the *CC/PP* [15] standard provides, divided in three main groups: a) the *hardware platform* which has information about processing speed, memory, autonomy with regard to the battery duration and to the screen resolution (width and height). b) The *software platform* has information about the versions of the operating system and the supported formats. And finally, c) the *individual applications* show information about the applications like browsers with their different versions and manufacturers.

After these layers, we can find user data related to his/her *MD*. That is, the user preferences with regard to: *i)* the specific metrics defined by user that the *MD* will try to fulfill such as, not to wait more than X seconds in order to display information, and so would prevent showing it, for example, in video. *ii)* The *spatio-temporal context*, when and where the user wants to see displayed the information. The *MD* can determine, according to the user preferences, if certain information can be displayed. For example, if the user does not want to be interrupted while he/she sleeps and so, if the *MD* is turns on and no silence mode, in this period, any event will be reported as a sound. On the user layer, we can find the *session preferences* which are a particularization of any preferences just mentioned but that are only valid for that session. They are used in order to consider exceptions which are not in contradiction

with the profile, having for example, a behavior which is not permanent. For example, a person can have like one of his/her permanent preferences that all requested information does not have a delay superior to five seconds for loading; if a Sunday such user wants to watch all the news in video (thus, loading delays more than five seconds), it is possible to display this information on his/her *MD* and the latter must put this preference as "*temporal*" one in order to establish his/her preference for the video format. Fig. 3a presents the *MD* profile module.

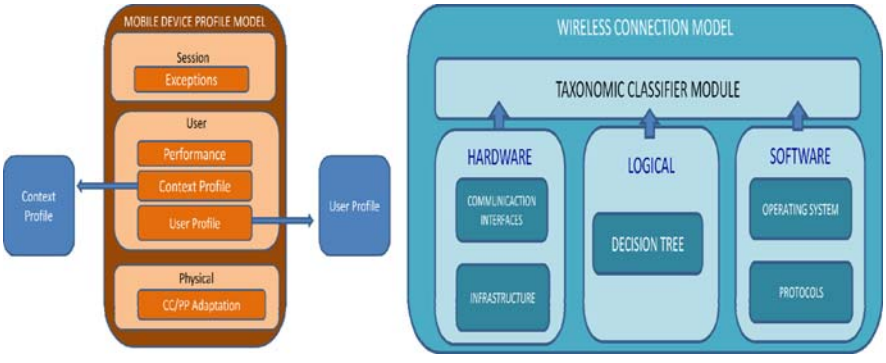

Fig. 3. (a) *MD* profile Model. (b) Connection Wireless Module.

The ***connection wireless model*** (see Fig. 3b) has four main modules which accomplish with the function of collecting information that can be considered in order to connect the *MD* in the best possible way in a determined moment: *i)* The *hardware module* takes into account the communication interfaces of the device with which he/she wants to access to the information, and the communication infrastructure of the *IS*. The communication interfaces correspond to those adapters installed into the *MD* which allow the connection (*e.g.*, Bluetooth, IrDa, Wi-Fi). The concept of infrastructure corresponds to the set of devices which are present in the environment and which allow the reception of connection and communication requests from the *MD* (*e.g.*, access points). *ii)* The *software module* takes into account the communication protocols and the respective operating systems supported as much by the *IS* as by the *MD* in order to validate the interoperability between the different hardware devices (defined in the *hardware module*). *iii)* The logical *module* has a decision tree which is crossed by levels, allows the selection of the more adequate technology considering as reference the characteristics: a) of the application, b) of the users and c) of the data which will be managed in the system. This decision tree does not takes into account own characteristics of the network nor those of the *MD* because this information is managed by the *hardware and software modules*. *iv)* The *taxonomic classifier module* extracts the characteristics from the hardware, software and logical modules: a) of the network to which *MD* is connected, b) of the *MD*, c) of the application, d) of the users and e) of the data, in order to select the best

configuration to be used by the application. This classifier notifies which is the best configuration, for example, Bluetooth, Wi-Fi, 3.5G.

On the *adaptation layer*, we find the ***general services layer*** which consists in an implementation of services such as: *i)* Reservation of a turn at the arrival to the establishment, notifying to the client at the moment in which he/she can be attended in order to acquire or to use the different products/services of the establishment. *ii)* Query of the catalogue of products/services using his/her *MD*, in the way in which the client could have the needed information displayed without executing an exhaustive information search. *iii)* To make his/her order according to a catalogue. *iv)* Shipment of promotions and messages with general information to each user according to his/her profile and his/her interests.

Above the *general services layer*, we can find the *personalized services layer*. The objective of this layer is to particularize the general services to a specific commercial establishment, adapting to the establishment needs. For example, the *general service* "Show catalogue" for the specific case of a restaurant, corresponds to "Show menu" in the personalized services layer. In addition, it is necessary to consider the adaptation layer in order to personalize the information to be displayed on the *MD*.

Above the *adaptation and general and personalized services layers,* we find the layer in which the application or the specific prototype of the commercial establishment executes. In this layer, graphics interfaces are built and the mechanisms of getting user information which will be processed by the remainder of layers. This interface does not do the adaptation process. It is only the input/output interface which provides needed information to the lower layers in order to process the queries. For the study case of this paper, we developed a prototype and its respective tests, oriented to a restaurant.

3 Study Case of a Restaurant

As we present in previous sections, ***PlaSerEs*** is aimed at helping to the commercial establishments to provide a best information service to their clients. A kind of these establishments is the restaurants which take care of millions of people daily. We consider that the restaurants become a complete case of study that shows how ***PlaSerEs*** would work in the real world. Fig. 4 shows for each layer of the architecture, which content could be present and what kind of information or services each module can provide. In order to evaluate the behavior of ***PlaSerEs***, a prototype for a restaurant was developed. This prototype uses the adaptation model of the platform in order to display the information in the most adequate way according to the user characteristics and his/her context. ***PlaSerEs*** offers a screen which allows access to the users registered in the system. The new users must register in the system. The registry of new users is done by means of a screen, in which they enter their personal data in order to complete their user profile. The preliminary registry can finish in the previous screen but the prototype allows establishing preferences about the restaurant menu, the ingredients or the maximum value of the bill that user wishes to pay. All of these constraints are included in the preferences screen (see Fig. 5a).

When the user is just registered in the system and enters successfully to the system, he/she finds the main menu. This menu contains all the services provided by the prototype. Each one of the services, which can be accessed from this interface, is the

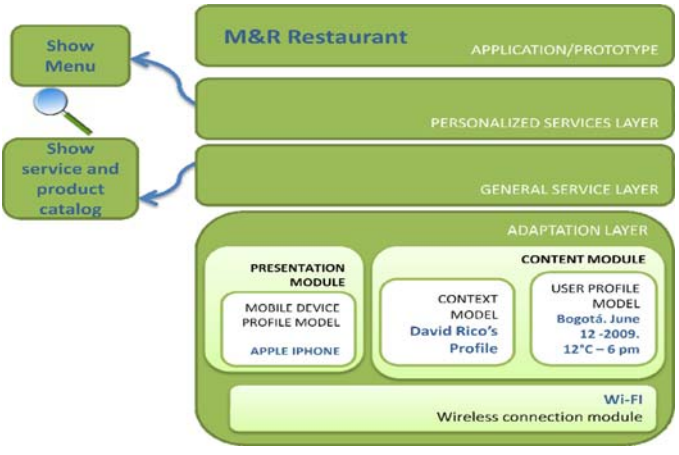

Fig. 4. Platform ***PlaSerEs*** used for a restaurant

Fig. 5. (a)Screen of entering the preferences in the prototype of a restaurant located in Bogota. (b) Screen of the menu of the prototype.

personalized services of the platform. These services show how the general services are personalized for the specific case of a restaurant. For example, "*Show menu*" (specialization of the general service "*Show catalogue*") is the first service to which the user can access from the main menu. In this screen, we can see the adaptation of the information because it takes into account the preferences that the user entered in the preferences screen (see Fig. 5a). In the interface of "*Show menu*" (Fig. 5b), we can see the products which are available for the user. These products are ordered, showing at the first places, those whose preference will be higher and eliminating of

the list, those of which the user does not like. When a user is going to order a product, an additional screen is displayed. In this screen, detailed information is shown with the ingredients and the price of them. Such information is shown in order so the user can be sure that the product which is going to be ordered will be of his/her taste.

At the desired moment, a user can query the value of his/her bill and the products that he/she has consumed until the moment; the screen of bill control considers the budget restriction included by the user in his/her preferences. A message will be displayed when he/she will be very close or he/she just passed in front of this establishment. This service is a specialization of the "bill control". There is a screen which shows the actual promotions in the establishment and they are shown, ordered according to the user preferences related to the products. The establishment makes the promotions effective, communicating directly to the establishment and applying it to his/her bill. This service is a specialization of "*shipment of promotions*". At last, we find the screen which allows to make a reservation of table for the user who has not entered in the establishment and the service allows her/him, in addition, to configure his/her reservation in terms of the number of people who will be on the table and if the user wants to have his/her table in a smokers or non-smokers section. This screen also allows including a cellular phone number to which the user will be informed, (using *SMS*) that the reserved table is ready. This service is a specialization of "To reserve a turn".

After knowing in a detailed way the ***PlaSerEs*** platform, in the following section some related works are described. These works are related to the adaptation of information and ubiquitous computing, aspects considered at developing this platform.

4 Related Works

"***PlaSerEs***" is a platform which relates the concepts of ubiquitous computing and adaptation in order to provide services to the clients of the commercial establishments.

Table 1. Related Works with ubiquitous computing and adaptation subjects

	MyCampus[5]	AMIGO[1]	ASAM[3]	Berhe *et al*[2]	***PlaSerEs***
Ubiquitous access	+	+	+	+	+
Adaptation to the content	+	+	+	+	+
Adaptation to the presentation	?	?	-	?	+
Adaptation to the *MD*	-	-	+	-	+
Adaptation to the context	+	+	+	+	+

In the Table 1, we can find a comparison among some works which apply the concepts of adaptation or personalization combined with the basic concepts of the ubiquitous computing. In addition, it is important to highlight the adaptation aspects which are being considered. This table uses the following notation: "+" if the work contemplates this aspect, "–" if it does not contemplate this aspect "?" if there is not

enough information about this aspect. We can conclude that all of these works allow as much the access when user wants, as the adaptation of the content and considering the context. These aspects have been considered as the most important because it is very relevant that a user can connect to and also, the information will be adapted according to his/her location (that is, adaptation of the content). The aspects of adaptation of the presentation and considering the access device have not been widely worked, mainly because each work is limited to a specific *MD* and they do not allow scalability in this aspect. Nowadays, it is necessary that the applications allow this, because all the users do not have the same *MD*. Therefore, as much the adaptation to the presentation and as to the device like the adaptation of the content (considering the context), must be aspects equally important to consider for new applications.

5 Conclusions

PlaSerEs was developed in order to provide to the commercial establishments, the possibility of offering personalized services to their clients. For making this possible, the internal architecture of this platform takes into account user characteristics and his/her context. The models developed with adaptation purposes are: a) of the user profile b) of the context of use which includes characteristics which affects the interaction between the *IS* and the user, depending on his/her location; for all people in the same place, this model presents the information in the same way. c) Of the *MD* profile which describes the device used by the user for connecting; this profile defines the best display of the information which will be given. d) Of the connection wireless profile which allows personalizing the information according to the available connections as much in the establishment where the user is located, as the connections devices that user's *MD* has. These models are the main components of the ***adaptation layer*** which allows to ***PlaSerEs*** to show the information with a personalized content and presentation. This information is given through the invocation of services provided by the commercial establishments. These services are described and defined in the ***general services layer***. The particular implementations (developed for a specific commercial establishment) of these services belongs to the ***personalized services layer***. In order to validate and evaluate the accomplishment of the ***PlaSerEs*** objectives, we developed a prototype which provides adapted services to users of a restaurant, taking into account the user profiles, their *MD*, the available connection wireless and their context of use. This prototype produced successful results in the tests cases.

As future work, we want to verify if the list of services defined is enough for all the possible clients of the platform. It is necessary to define if we have to add new general services and to consider the impact produced by these additions in the other components of the architecture. For example, if we want to include the service of paying the bill, we have to include a security component which connects itself to the bank and allows making the payments in a successful way. In addition, the data model must include user banking information so that he/she can pay his/her bill in an automatic way, each time that he/she uses the platform. In conclusion, in order to include the general service of paying the bill into ***PlaSerEs***, it is not necessary to modify any existent modules. It is only necessary to create a security model which allows paying the bills. Additionally, it is necessary to research about the market needs in order to identify general services, not included in ***PlaSerEs***.

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