A Model to Bring Back the User in the Center of Context Understanding in Ubiquitous Environment.

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1. Introduction

We know the typical example of the ubiquitous museum where, when we arrive close to an exhibition we receive the exhibit explanation in the museum device's headphone. We can also change the language or eventually cut off the listening. Also, when we enter/leave a new office room, the light goes on/off automatically. In these simple life scenarios, we naturally get the feeling that our presence was sensed. In some cases like in the museum we can control it.

In the present and future world, there are and it will exist many situations where this feedback and control are not natural or even not provided to the user. For example surveillance and office cameras, public transportation systems that will identifying the passengers, intelligent cars which will sense several physical parameters in order to adapt driving systems, intelligent rooms which infer user's feelings to adapt the room ambient parameters...

In a more and more complex ubiquitous environment, it is important to bring to the user the understanding of this environment, therefore the knowledge of the environment sensing. Our research aims at giving this feedback and control to the user. yet it raises different questions: what, when and how to present sensing information to the user and give him their control. In this kind of issue, described by G.Abowd as new issues in ubiquitous computing [1], a context model is also required.

2. Model goal

Since Mark Weiser [2] introduced Ubiquitous Computing, one of the main issues has been to make the machines understanding the user situation in order to bring context awareness [1]. Many researchers defined user context by a set of information depending on their application needs (location, time...). A.Day and G.Abwod in [3, 4] attempted to bring a general definition about user context and what should be context awareness. This context model which aims at describing fully the current user situation in order to bring the right interaction at the right time [5] is still a grail.

In our purpose, the context model aims to represent a certain point of view about the user context. It represents information which are important for the user to know if the ubiquitous environment sense them and, in some situations to control them. It is a subset of the user context. Therefore it can be exhaustive.

3. Model description

The representation model needed to fill our need contains seven dimensions, which are (Image, Identity, Location, Social, Activity, Physical and Emotion) as shown in Fig.1.

- **Identity** characterize a sensing which concern the user Identity. It can be quantified by scale, from anonymous to a full user identity (name , address, social number...)

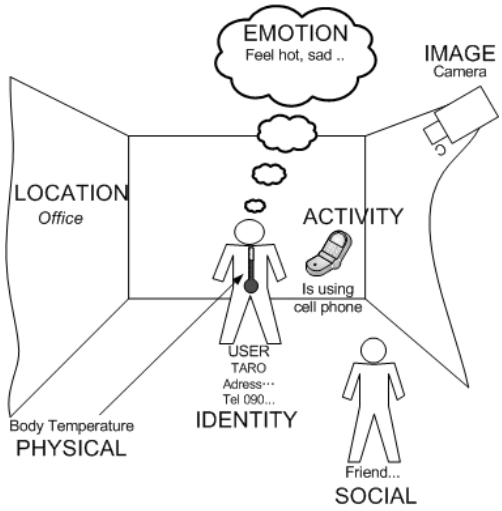

Figure 1: The model dimensions

- **Location** characterize a sensing which concern user location. Location can also be quantified by scale according to the sensed information precision (city, office,room, precise geographic position).

- **Activity** characterize a sensing witch concern user activity. The sensed activity can also be differently precise (user is at work, in a meeting, or is talking to the cell phone..).

- **Image** is used to characterize a sensing which concern user image. Image scale will be linked to the zoom of this sensed image.

- **Social** is used to characterize sensing which concern the social environment of the user. for example the user is currently with taro and with his group team mates.

- **Physical** is used to characterize sensing which concern the internal physical variable of the user (body temperature, heart beat, blood pressure...).

- **Emotion** is used to characterize a sensing which infer emotional user information (user feels hot...).

There are two kinds of possible sensing information we need to characterize. One senses directly user's characteristics and the other senses user's environment information (room temperature...). The environment information is characterized by the "user impact" induced by the use of this information. For example, if a system uses the room temp information to control the eating system it have an impact on user emotion, feeling more or less hot then can be characterize by emotion dimension.

In previous researches context descriptions, we can distinguish similar dimensions or categories. As A.dey shown in [3, 4] on different examples, researchers focused on limited set of information depending on the application. After provide a general definition of user context, A.dey described that, Location, Identity, Activity and Time are the most important categories of context. Excluding time, we can find them in our set of dimensions.

However, as we described in the model goal, these categories aim at characterizing the user's situation. In our model these dimensions aim at characterizing the information that are sensed by Ubiquitous environment and evaluates this sensing intrusion on the user in a current situation. For this purpose, the categories described in previous research cannot match every sensing information. Therefore Emotion, Physical, Image and Social dimensions have been added to our set. There are some research where Emotion, Physical or Social informations are considered but not all together and for specific applications. Our seven chosen categories are a complete set of dimension to characterize sensed information according to the context model point of view in our need.

Although, to complete the characterization of sensing, the model needs other important information which influences when to inform and to give a certain control to the user.

- **The proximity between application and user**: Does the application is a public or a private one? It is principally influencing the control.

- **The sensing perception field**: It has three states, the user can be "out" perception field then the information is kept hidden to him. The user can be "in" or "potentially in" the perception field, then sensing information can be shown and the control be given with a different probability between these two states. The "potential" state exists to represent situations where the user is in a physical space containing sensing, but these sensing do not focus on him yet, like a Pan-Tilt-Zoom(PTZ) camera which is looking somewhere else.

- **The user perception field**: It represents the general space where the user can detect the sensing by himself. It influences the probability of informing the user. For instance, if the camera is big and its presence obvious there is no need to inform the user specifically, therefore disturbing him.

4. Filtering: model use

We can use these representations to determine, in a specific situation, if the user must be informed about a sensing and when we can provide him with a certain control about it. We call this decision "filtering".

The ubiquitous application itself determines the quantification of its sensing information. This quantification can be static or dynamic. For example, the user image and activity influence of a PTZ camera will dynamically change depending on the zoom applied to observe the user. The identification and the presence sensing user influence in an office building will be mainly static. The following table shows examples about some sensing information dimension influence qualification (Fig.2). A specific sensing information can concern one or several dimensions in the model. For example a surveillance camera senses information on the user image, can allow to infer the user identity and the user location. A system which is inferring if the user feels hot may sense several physical parameters and user location then infer user emotion.

Each dimension used is quantified by some normalized value depending on its scale of influence. A full Identification sensing will have a high value close to 1, while just the name or an anonymous identification will have one close to 0. Then these marks will be given some coefficients weight which represent the difference of importance the humans allow to each dimension. This pondering will be provided by a study experiment.

	ID	Loc	Activity	Image	Social	Physical	Emotion
Surveillance camera	1	1		1			
User ambient temperature Feeling		1				1	1
User activity sensing (Ubiquitous schedule)	1	1	1				
Office building presence id	1	1					

Figure 2: Sensing influence example

The pondering associated to the mark and the other model information proximity and perception fields give a global intrusion mark. This mark is compared to a detection threshold level provided as user preferences. This comparison decides if the user must be informed about this sensing information.

5. Conclusion

In this paper we described a model of context designed from a different point of view than the traditional one in context aware computing. It allows expressing the ubiquitous environment understanding about the user situation. Therefore, it can provide to the user the feedback and in some situations the control of the environment sensing. We described this model with its seven dimensions, showed its differences between traditional context models used in context awareness. We described this model use for characterizing and filter the sensing information.

We need to evaluate the model accuracy and completeness. An experiment will be made to initialize the dimension pondering parameters for the filter. We need to design a module that will implement this model to provide these services to the user and apply this model on concrete ubiquitous scenario.

References

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