Human Computer Interaction Pattern in Pervasive Computing

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ABSTRACT: *Pervasive or Ubiquitous computing is a paradigm characterized by millions of self communicating intelligent devices, taking active role in every activity of human life.*

Ubiquitous computing presents some challenges across computer science: in system design engineering, in system modeling and in human computer interaction modeling. Traditional human computer interaction models like command line, menu driven, GUI based, will be inappropriate to ubiquitous computing situation. The "natural interaction paradigm" appropriate for fully robust pervasive computing has yet to be emerged. This research document tries to model human computer interaction pattern in pervasive computing.

Keywords: Interaction, HCI, Interaction Design, Patterns, Pervasive Systems, Ubicomp, Interaction Patterns

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History

Embedded computing and wireless communication technology are developing rapidly, which promoted the combination of computing, communications and sensor fusion technology. This makes human's three dimensional physical space unprecedented with full of data and information, and people also hope to get an access to information and computing services in our life and the environment any time and anywhere. Thus, Mark Weiser proposed the idea of ubiquitous computing based on preliminary studies such as human-computer interaction, network technology, computing technology and the evolution of the graphical user interface and so on in 1988. In 1991, Weiser has done a more systematic and comprehensive exposition on ubiquitous computing in his paper "*The Computer for the 21st Century*". He described a computing environment where computing devices are seamlessly embedded in the everyday objects of our lives and interwoven with the physical world through a continuous network, so that the computer itself disappeared from the people's attention, and people's attention can back to the task itself.

Now, a number of relatively self-contained research fields based on ubiquitous Computing have been formed such as smart space, wearable computing, Context-aware computing and nomadic computing.

1. Introduction

The Human-Computer Interaction field emerged 25 years ago with the aim of improving the interaction between people and computers. However, with the computer "*becoming liberated from the desktop*" [1], such interaction presents other challenges and opportunities. Computer systems have become ubiquitous in every aspect of our lives while becoming less visible as separate and distinct artefacts. This paper reviews the current literature in pervasive systems in order to identify some patterns of interaction, considering non-traditional modalities of interaction, like interaction with mobile devices, intelligent environments, and other users that are equipped with mobile devices. In order to limit the scope of this overview, we are particularly interested in those that are relevant to motion aware systems. This paper is organized as follows: In section 2 we offer a definition of interaction, followed by a review of how traditional human-computer interaction (HCI) came into being, and then a discussion of the challenges that ubiquitous computing brings to HCI. Section 3 is about the pattern approach, and user HCI Modeling. In section 4, we turn our interest towards interaction patterns, most especially those emerging while designing pervasive systems. Here we offer examples in motion aware systems in which some of these patterns can be used. Finally, in section 5 we present some conclusions to be drawn from this review.

2. Human Computer Interaction

This section concerns the field of Human-Computer Interaction and its evolution over the years leading up to the design of pervasive systems, which is our concern. Firstly, we need to define interaction in a way that it is not only accurate, but flexible enough to be used in the context of HCI in pervasive systems

3. User Modeling in HCI

Some HCI researchers have been interested in user modeling because there is the potential that user modeling techniques will improve the collaborative nature of human computer systems. In the context of this article, user models are defined as models that systems have of users that reside inside a computational environment. They should be differentiated from mental models that users have of systems and tasks that reside in the heads of users, in interactions with others and with artifacts (the models D1, D2, and D3 in Figure 4 are examples of mental models). Descriptions of some specific user modeling attempts and challenges in HCI how the west was won an early success example of user modeling the west system (Burton and Brown, 1982) represents an early pioneering effort to explore issues associated with user modeling. WEST was a coaching system for a game called "*How the West was Won*" that was modeled [4] on "*Chutes and Ladders*." The players rotate three spinners and have to form an arithmetic expression from the three numbers that turn up on the spinners using and appropriate parentheses (and they have to specify what the value of the expression is).

If players land on a town (towns occur every 10 spaces), they move forward to the next town. If they land on a chute, they slide to the end of the chute. If they land on an opponent, that opponent is sent back two towns.[7] The optimal strategy is to figure out all the possible moves and take the one that puts you farthest ahead of your opponents. But empirical analyses showed that students did not use this strategy, they were much more likely to rely on a strategy such as adding the two smallest numbers and multiplying by the largest. The WEST coach analyzed student's moves in terms of the optimal strategy and could rate the moves with respect to that strategy. It watched to see if the students consistently followed a less-than-optimal strategy, such as not taking opportunities to land on a town or chute or opponent. If the WEST coach detected such a pattern, it would intervene at an opportune time, when the student's move was far from optimal, and it would point out how the student could have done much better. It then would give the student a chance to take the move over. In the context of WEST, the following problems of user modeling were explored:

4. Interaction Patterns In Ubicomp

According to Michel Beaudouin-Lafon [5] there are three interaction paradigms: first-person interfaces, in which users interact in a dedicated manner with a computer, as within traditional HCI research, and can follow the rules of direct manipulation; then second-person interfaces, in which users delegate some tasks to the system, who is seen as a "*partner*" assisting in reaching the user's goal as in the cruise control example of section II.C; and finally, third-person interfaces, where the system mediates the interaction among various users, such as in the case of computer-supported cooperative work and social networks.

5. Conclusion

The application of design patterns to pervasive computing systems opens up interesting research questions. The diversity and abundance of the research in this new area is an indication of how difficult it is to create a pattern collection that is universally accepted. Questions remain about how to validate the collection given the time and expense required to test each interaction pattern; and how to evaluate the process of using them, since conducting controlled studies is sometimes seen as prohibitive because of the creativity and skill involved in the act of design. As Landay and Borriello point out, the process of developing design patterns is still fairly *ad hoc* [8]. All of these elements suggest that the adoption of a widely accepted pattern collection for interactions is unlikely in the immediate future.

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