Smart Content Selection for Public Displays in Ambient Intelligence Environments

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ABSTRACT

A public display that is able to present the right information at the right time is a very compelling concept. However, realising or even approaching this ability to autonomously select appropriate content based on some interpretation of the surrounding social context represents a major challenge. This article provides an overview of the key challenges involved and an exploration of some of the main alternatives available. It also describes a novel place-based content adaptation system that autonomously selects from web sources the content deemed more relevant according to a dynamic place model. This model is based on a tag cloud that combines content suggestions expressed by multiple place visitors with those expressed by the place owner. Evaluation results have shown that a place tag cloud can provide a valuable approach to this issue and that people recognize and understand the sensitivity of the system to their demands.

Keywords: Ambient Intelligence, Context-Awareness, Human-Centred, Public Displays, Recommender Systems, Ubiquitous Computing

1. INTRODUCTION

In Ambient Intelligence scenarios, the environment can perceive and react to people, sense on-going Human activities and proactively respond to them. Public digital displays have always been part of this vision (the “boards” (Weiser, 1993)), and their increasingly ubiquitous presence in our socio-digital landscape has been opening new opportunities for their use as important building blocks for many types of Ambient Intelligence multimedia environments. However, most public displays today are mere distribution points for pre-defined and centrally created content. They assume passive users and they are completely unaware of the Human activities taking place at that same location. Consequently, they are not very valued by their potential users and their content is often perceived as too institutional or dull (Huang, Koster, & Borchers, 2009).

The solution may be found in their ability to dynamically integrate content from the web and select sources according to their relevance.
to the social context around the display. The number and diversity of content sources on the Internet offers the potential to guarantee a continuously updated stream of relevant content for the displays. The potential is so vast that we can safely say that content would no longer be a scarce resource and that proper selection would indeed become the key problem. Mobile technology, on the other hand, may offer the potential to implement multiple forms of automated personalization, or adaptation, of the displays. The possibility to collect preference expressions from people near the display could enable content that is tailored to the preferences or goals of the individuals or groups visiting the place where the display is set, considerably improving the user experience and enriching the place characterization with the preferences and goals of visitors. This would make each display system unique and closely related with the specific place where it is installed, providing the ground for highly situated displays that reflect the expectations, interests and practices associated with the people in a particular place. The problem of place-based content adaptation in public displays may thus be formulated as follows: Given a set of preferences implicitly or explicitly expressed by the people around a display, how can they be combined with the characteristics of the place to enable the system to select from web sources the most appropriate content to be displayed in that context.

This paper reports on the final results of a research program aiming to uncover content adaptation strategies for public displays based on the preferences of nearby people. It provides an overview of the key challenges involved and an exploration of some of the main alternatives available. As part of this work, we have developed a public display system that autonomously selects from web sources the content deemed more relevant according to a dynamic place model that is sensitive to the people around the display. People can express their content preferences by specifying tags in their Bluetooth device name, as described in José, Otero, Izadi, and Harper (2008). These tags, together with seed tags defined by a place owner constitute a tag cloud that is continuously reflecting the social setting around the display, being sensitive to immediate indications of interest and providing a balanced combination between content suggestions expressed by multiple place visitors and those expressed by the place owner. This tag cloud is then used as the basis for an adaption process that addresses the specific requirements raised by content selection in public displays. The results obtained with the evaluation studies show that place visitors recognize the sensitivity of the system to their demands and that a place tag cloud can provide an important element for the interpretation of place and for combining the dynamic set of interests expressed by multiple people. Overall, these studies provide a relevant contribution towards understanding the implications of adaptation approaches for public displays and more generally to the discussion in the community regarding adaptive behaviour in public spaces.

2. CHALLENGES IN ADAPTIVE CONTENT FOR PUBLIC DISPLAYS

The idea of a public display that is able to present the right information to the right users, at the right time and in the right way is obviously very compelling. However, realising it, or even approaching it in some way, is extremely challenging because of the complex issues involved, such as obtaining information about preferences in a non-obtrusive and privacy-preserving way, the need to combine the various preferences expressions of the people in that place, and the complexities involved with making meaningful inferences about relevance based on the information available. Instead of a pre-defined schedule, the system would work based on policies that determine the high-level behaviour of the system, but not exactly what it will do. In the end, the effective behaviour exhibited by the system will result from the combination between those policies and the stimuli received from the environment. When considering how to approach this goal, we have explored two
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