Chapter 12
Context–Aware Cultural Heritage Environments

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ABSTRACT

Cultural heritage environments, like museums, archaeological sites and cultural heritage cities, have gathered and preserved artefacts and relevant content for years. Today's state of the art technology allows the shift from traditional exhibitions to ones with reinforced interaction among the cultural heritage environment and the visitor. For example, mobile applications have proved to be suitable to support such new forms of interaction. Effective interaction exploits information both from the cultural environment, the visitor, and the broader context in which they occur. The aim of this chapter is to present the value of context in applications designed for cultural heritage environments and to demonstrate an infrastructure that effectively exploits it.

INTRODUCTION

Nowadays, cultural heritage environments, like museums, archaeological sites, cultural heritage cities, city authorities, etc, select to disseminate and present the artefacts and relevant content that they have gathered and preserved for years not only via traditional exhibitions but also through the web and multimedia applications. The aggregated content is extensive both in topics and in depth; semantic web technologies, like ontologies that are the most prominent technology for cultural-related information and knowledge representation, have been applied in order to annotate and organise it.

So far, the presentation of cultural content focused on web applications, like web portals. In the 21st century web remains the primary platform for content access, but the desktop as a means for access has diminished influence. Lately, there has been a shift towards on site content access using feature rich portable devices, like enhanced mobile phones, netbooks, pdas, etc. The advent of the ubiquitous and mobile computing technologies has led to the development of various mobile ap-

plications for cultural environments that enhance the experience of visitors via improved interaction with exhibits and content.

These applications follow Weiser's vision (Weiser, 1991) for ubiquitous computing as their aim is to seamlessly integrate into the environment, to take into account the natural human environment and to aid visitors to interact with the cultural heritage site. Effective interaction exploits information both from the environment and the visitor; in the broader sense from the context in which it occurs. Context-aware cultural applications exploit context to adapt their behaviour and offer seamless interaction to support the visitor's activities.

In the case of indoor cultural heritage environments, like museums, the relevant context is mainly determined by the profile of the visitor, his location on the site, the path he follows, the capabilities of the device that he uses, etc. When the cultural heritage environment becomes citywide, the main context parameters remain the same; however there is abundance of context providers. Effective exploitation of context affects both the selection of relevant content for the visitor and the selection of suitable interaction methods. Cultural heritage environments seek to offer more attractive interaction with the visitors; thus a number of context-aware cultural applications have been developed to provide this.

The aim of this chapter is to present the value of context in cultural heritage applications and to demonstrate an infrastructure for creating context-aware cultural applications. This chapter initially discusses context-awareness in cultural heritage applications by defining what context is in cultural heritage environments and how it can enhance a visitor's experience. Following, an infrastructure for context-aware cultural heritage applications is presented; this infrastructure is based on an ontology-based context model, which allows the decoupling of context capture and management, and on a context management system that exploits a reasoning process.

A VIEW ON CONTEXT-AWARE CULTURAL ENVIRONMENT APPLICATIONS

The concept of context-aware computing was introduced in (Weiser, 1991), where Weiser describes ubiquitous computing as a phenomenon 'that takes into account the natural human environment and allows the computers themselves to vanish into the background.' He also shaped the fundamental concepts of context-aware computing, with computers that are able to capture and retrieve context-based information and offer seamless interaction to support the user's current tasks, and with each computer being able to 'adapt its behavior in significant ways' to the captured context.

The term "context-aware" was first introduced by Schilit and Theimer (1994), who defined it as software that "adapts according to its location of use, the collections of nearby people and objects, as well as changes to those objects over time". Schilit, Adams and Want (1994) defined context as "the constantly changing execution environment" and they classified context into computing environment, user environment, and physical environment. Schmidt (2000) also considered situational context, such as the location or the state of a device, and defined context as knowledge about the state of the user and device, including surroundings, situation and tasks and pointing out the fact that context is more than location.

An interesting theoretical framework has been proposed by Dix et al. (2000), regarding the notions of space and location as constituent aspects of context. According to this framework context is decomposed into four dimensions, which complement and interact with each other. These dimensions are: system, infrastructure, domain and physical context.

One of the most complete definitions for context was given by Dey (2001); according to whom context is "any information that can be used to characterize the situation of an entity. An entity

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