The Ambient Digital Library

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ABSTRACT

Conventional digital libraries increasingly support remote access from mobile devices. However, the archetypical mobile user differs from the conventional user in a number of aspects; of these the most important is context. Synonymous with mobile computing is the context concept, and factoring the availability of select contextual elements into the design of digital libraries offers significant opportunities for adapting and personalising services for the mobile computing community. This paper proposes the Ambient Digital Library as a construct for integrating digital content, contextual parameters, and user models. In this way, a digital library may be made more accessible to a broader category of mobile user.

Keywords: Ambient Digital Library, Ambient Intelligence, Context, Digital Libraries, Mobile Computing, Mobile Computing Community

INTRODUCTION

As the relentless growth of mobile computing continues, there is an increasing demand for new and innovative services in various general and specialist application domains. Developments in mobile communications have been of fundamental importance; accessing up-to-date information of various hues in practically real-time conditions is commonplace, particularly through the use of mobile internet technologies. As this scenario evolves, significant new markets will continually open up to innovative content providers.

Conventional libraries are frequently perceived as rather static conservative entities. Digital libraries, by their incorporation of digital technologies, may be perceived as more dynamic and responsive to user requirements; yet this may be a false perception. Unless a proactive and innovative approach is taken to library design, a digital library may ultimately mirror its physical counterpart in being perceived as a largely static repository. Objectively, this situation is worse in that digital libraries by their very nature have opportunities to deliver a rich set of tailored services in diverse ways that are not available to their physical counterparts. Supporting mobile users in the fulfillment of various, albeit specialised, tasks is one example.

The Ambient Digital Library is proposed as an enabling construct for facilitating universal mobile access to information. Inherent in its design is an acute awareness of the dynamic nature of mobile users. The notion of context offers a vehicle by which this dynamic may be encapsulated. In this way, information can be filtered and prioritised in real-time according to the needs of the mobile user at any time juncture.

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THE DIGITAL LIBRARY
CONSTRUCT

Research in digital libraries has been ongoing since the early 1990s. Objectively, such libraries may be regarded as amongst the most complex forms of information systems (Fox & Marchionini, 1998) as many different disciplines, for example, databases, information retrieval and Web technologies, contribute to their definition and implementation. One of the inherent difficulties in a multi-disciplinary paradigm is that the expectations of various constituencies may differ. For example, researchers regard a digital library as constituting digital content assembled on behalf of some interested community while librarians focus on the institutional or service perspective (Borgman, 1999). For the purposes of this discussion, the former view is subscribed to.

In recent years, there has been significant effort directed towards establishing some theoretical foundations for digital libraries (Candela et al., 2010). One example of this is the Digital Library Manifesto (Ross, 2010), an initiative of the DELOS Network of Excellence. Such developments are essential if key challenges such as interoperability are to be overcome (Suleman, 2011). Despite a lack of formal foundations, many digital libraries have been developed, albeit in a rather ad-hoc fashion. A variety of subjects are covered, many in the sciences and humanities, for example, archaeology (Ravindranathan et al., 2004) and mathematics (Sylwestrzk et al., 2010).

Developments in mobile computing have led some researchers to investigate the issue of digital library access from mobile devices (Jensen, 2010; Marshall et al., 2001). DL2GO represents a framework for enabling editable and portable personal digital libraries (Kil et al., 2008). How the ubiquitous iPod may host a digital library has also been explored (Bainbridge et al., 2008). In Japan, a tsunami digital library has been developed with the expressed objective of supporting access via mobile phones (Imai et al., 2007).

A common characteristic of many digital libraries is the relatively static nature of content access and presentation. Synonymous with mobile users is the notion of context, a construct that seeks to encapsulate the dynamic nature of the mobile user in a multitude of dimensions. The objective of an Ambient Digital Library is to reflect this dynamic. Thus an Ambient Digital Library seeks to present its content to reflect the prevailing context of the mobile user. To do this, it is necessary that the digital corpus be tagged with additional metadata, and augmented with additional functionality, such that it can filter, personalise and contextualise content as user context demands.

A REVIEW OF CONTEXT
IN MOBILE COMPUTING

Context is a particularly attractive construct in mobile computing application. As understanding of the mobile computing paradigm matured, it became clear that the prevailing situation at the time of service invocation was dynamic and unpredictable; and that this would have significant implications for usability as well as other aspects of the software engineering process. Though the nomadic nature of the end-user became a critical differentiator from standard desktop computing, it was quickly realised that a significant opportunity existed for customising services according to the situation that the end-users found themselves. Thus interest in the potential and use of context in mobile computing increased.

Intriguingly, defining context has proved problematic, despite it being a relatively intuitive concept. An examination of the literature will reveal a number of attempts at defining context including (Schilit et al., 1994; Dey, 2001). The International Standards Organisation (ISO) also has a formal definition (ISO, 1998). Conceiving another definition is inappropriate in this instance; however, it is useful to examine the various elements of context that may be harnessed in the delivery of services to mobile users. In this way, a better understand-
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