USING WEB 2.0 TECHNOLOGIES TO PRESERVE DESIGN HISTORY AND IMPROVE COLLABORATION

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Abstract. This paper describes ongoing research into how emerging Internet concepts used in conjunction with existing Information Technologies (IT) can improve inter-project communication and understanding. The emphasis of the research is to use technology as an enabler to share personal thoughts and enhance the conversation that takes place within a development team. It stems from the observation that the emphasis of many new Architecture, Engineering and Construction (AEC) technologies is to minimise and diffuse project conversation with highly complex, machine interpretable building information models.

Project teams are usually brought together for a relatively short but intense period of time. Following project completion these unique teams are dissolved just as quickly and often are never formed again. As a consequence it is difficult to justify the investment in time and resources required to implement complex IT-based collaboration solutions. A further barrier to adoption is the differential application of IT skills across the AEC industry. Therefore in order for a new technology to gain broad acceptance and be most beneficial it must be applicable to the broadest audience with the minimum investment required from all parties.

The primary objective of this research is to preserve the rich design history of a project from conception to completion. Submitted information can be intelligently searched using the meta-data sourced from syndicated data feeds about team members, project timelines, work diaries and email communication. Once indexed users can tag documents and messages in order to provide a further, far richer layer of meta-data to assist in searching, identification of issues and semantic clarification. This strategy of defining AEC semantics through social interaction differs greatly from that of more complex, computer interpretable solutions such as Industry Foundation Classes. Rather than abstracting information to suit a generic yet highly

intelligent building model, the emphasis is on preserving the participant's own thoughts and conversation about decisions and issues in order to create a forum for intelligent conversation as the design evolves.

1. Introduction

Conversation and collaboration play a crucial role within the Architecture, Engineering and Construction (AEC) industry. No matter the technology employed, without effective communication or understanding of design issues as conveyed by the client the chances of successfully meeting project objectives are severely handicapped (Barrett, Hudson and Stanley, 1996). Currently there is no simple, transparent way of documenting, reviewing and searching this conversation throughout the lifecycle of a project. Consequently information about design decisions and issues are lost as development responsibilities shift between groups who maintain different objectives within a project. As greater amounts of project information and communication are recorded digitally it is becoming increasingly important that tools be developed to help participants navigate, search and interact with these digital resources so that across the project lifecycle important exchanges and events are not lost in a digital sea of data.

2. Technology to Assist Collaborative Design

Although the AEC industry has proven slow to adopt new process enhancing technologies it has been very swift in accepting email as a means of communication (Swee-Lean and Nga Na, 2004). More complex collaboration concepts such as the Building Information Model and project Intranets have struggled to gain the same level of acceptance even though research by Arayici and Aouad (2004) and Al-Reshaid (1999) has shown many benefits in their respective adoption. A factor identified by Anumba (1998) for this slow adoption is the limited time and financial resources available within AEC organizations to retrain staff and change internal and external collaboration processes.

2.1. STRUCTURED DATA AND CONVEYENCE OF SEMANTICS

There has been considerable research into how AEC data and knowledge can be digitally described, recorded and exchanged. Two notable efforts have been Industry Foundation Classes (IFC) and the LexiCon semantic system for the built environment.

IFC's are a structured, extensible model for digital AEC information (Wix and Liebich, 2001). Unfortunately even after ten years of development IFC's are still not comprehensive enough to satisfy all use cases, a factor in their limited adoption within the industry.

The LexiCon is not a data model but rather an effort to create a database of construction concepts (Woestenenk, 2002). The LexiCon can provide a language neutral way of describing construction information.

Both technologies if successfully implemented could infuse vast quantities of meta-data into digital AEC content. Unfortunately due to implementation issues and standard complexities neither have gained widespread industry acceptance or support within the AEC software market.

2.2. THINKING SMALL: PROJECT FOLKSONOMIES

An approach increasingly employed by Web-based data management tools is to allow users to apply their own semantic meaning (referred to as tags) to data. Through the process of 'tagging' smaller, less complicated semantic structures evolve. The structures are often not broadly applicable across an entire industry but are far more identifiable to the individual, resulting in increased use. These small semantic groupings are referred to as folksonomies (from the words 'folk' and 'taxonomy'), a term first used by Thomas Vander Wal in 2004 (Mathes, 2004).

3. What is Web 2.0?

Whether 'Web 2.0' exists is a matter of debate (O'Reilly, 2005). It is apparent that a significant change has occurred in how people interact with the Web. It has ceased to be a static, read-only environment and is now evolving into a far more dynamic, conversational experience (Hammersley, 2005). Driving this experiential change is a series of digital concepts; blogging, tagging and Really Simple Syndication.

Blogging is the act of personally writing articles for a website for public consumption and usually viewed in reverse chronological order (Nardi, Schiano and Gumbrecht, 2004). Like email the style of blogs are usually highly informal with little structure or preparation. The emphasis of the activity is placing thoughts or information online as quickly as possible for posterity and for others to comment upon (Cayzer, 2004).

Tagging as described previously is often employed in blogging and other data-rich Web environments to personally categorize information. There is usually little or no structure employed in a tagging folksonomy, instead as with blogging the emphasis is on speed and ease of use rather than structure or formal correctness.

Really Simple Syndication (RSS) provides an easy way for users to track updates to the Web automatically. This functionality has gained importance as the quantity of websites and the frequency that they are updated has grown. Consequently many users now use feed-aggregators to automatically identify new content which saves having to manually visit stale websites. Introducing this technology has made content on the Web more time-centric, as users are automatically alerted to the posting of new content minutes after creation.

Like email and HTML a key factor behind the widespread adoption of these technologies is that they are relatively simple to understand and implement (Bosworth, 2004). The collaborative design process could stand to be significantly improved through the integration of these technologies. Unlike the introduction of completely new tools the reutilization of existing technologies would ensure user familiarity is maintained and barriers to entry for new participants is significantly reduced.

4. Web 2.0 Collaborative Design

The following scenario is an outline of how Web 2.0 technologies could be used within the AEC environment to great effect. In a design team, important design considerations brought up in communication such as email and exchanged documents could be tagged with the design intent, its importance and how, if at all it related to other areas of the design. Using this information plus the passive meta-data provided by who posted this information and when, an automatically generated RSS feed would communicate to all involved current project goals and how they were evolving. Participants would be able to monitor and potentially join in with the conversation without any special software or training 'buy-in' thanks to the ubiquity of Web (HTML and RSS) enabled software.

Presently the design versioning process is relatively manual, requiring the notification of various parties by email or telephone of changes to files or printed documentation. The same RSS principles alongside online storage would provide a simple yet efficient way of managing file versioning across different groups. This approach acknowledges the use of multiple digital models in the design/development process and the necessity of notifying those using them of changes. Through the process of tagging and feed generation intelligent, continuously updated indexes could be built, allowing participants to search a project's design history to identify previous issues, solutions or key exchanges that without the benefit of RSS and tagging would have been buried in privately managed email accounts. Search results would not be as intelligent as those provided by a structured semantic model, but as contemporary search engines such as Google have proven (Vise, 2005), people are willing to forgo accuracy for speed and ease of use.

5. The Reasonate Platform Prototype

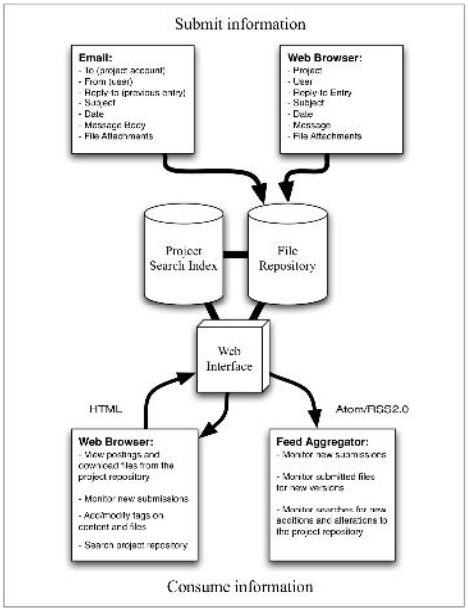

Figure 1. A basic input/output diagram of the Reasonate platform prototype

Reasonate is a technology prototype of Web 2.0 technologies applied within the AEC environment. It is being developed to test in several environments the benefits and drawbacks to the application of Web 2.0 concepts to the AEC design arena. The emphasis of the prototype is on the reutilization of existing software platforms, namely the Internet browser and email client to interact with the project knowledge base. Email or the browser client can be used to submit data to the system whilst the browser is used to explore, manage and search the resulting data repository.

Figure 1 illustrates the basic input/output components of the Reasonate platform. Submission rights are set at the server level whilst data access privileges are set using private or public tags. It is intended that users treat the system like a work log and submit information on a regular basis or as important decisions are made. It is also intended that email correspondence related to the project be sent to the Reasonate system for integration into conversation threads and indexing. Within the browser interface or within third party news aggregators RSS feeds of submissions, file updates and complex searches can be subscribed to in order for participants to gauge the progress of the design process. Whilst interacting with the documents

participants are able to tag pieces of information to help semantically categorize the data for later searching or cross-reference purposes.

6. Testing the Concepts

Generating a methodology to test the concept has proven difficult given the incomparable and intangible attributes of different design projects. A case study/prototype testing approach has been formulated in order to gauge the concept's applicability and usefulness within the AEC design environment. Testing will be undertaken in two environments, a controlled simulation environment and later within a selected group of architecture practices.

6.1 CONTROLLED PROOF OF CONCEPT

The first range of tests will take place at Victoria University of Wellington's Architecture School. Testing will be undertaken in BBSc303 Computer Applications (http://www.vuw.ac.nz/architecture/courses/), a course that focuses on the use of computers in the design documentation and analysis process. The first range of tests will be used as a proof of concept and a means of exploring how inexperienced users relate to the software.

A long-running course objective has been for students to digitally document their progress and collaboration issues. Reasonate will be used to achieve this task and at the end of the process student work and questionnaire feedback will be compared and evaluated against previous years work undertaken using traditional methods. To encourage online collaboration within a group of students who share the same physical space the class will be divided into two 'virtual' companies who must exchange all information digitally using the system. During this process it is hoped the shortcomings and issues associated to the system can be identified and developed further for the next phase of testing within architecture practice.

6.2 REAL WORLD APPLICATION

The second phase of testing will take place in several architecture practices beginning in July 2006. The testing will run for six months with the purpose of evaluating the concept's success when applied to the 'real world' design/development environment. Data collection will be through online questionnaires and a discussion group forum held at the end of the process. Whilst hypothesized that such technologies will greatly improve the AEC design process over the lifecycle of the project it is the author's opinion that feedback from users will highlight a number of conflicting and possibly inconclusive observations specific to the individual's experience. Drawing

general conclusions on benefits and drawbacks will be part of the evaluation process where results from both sets of experiments will be compared.

7. Conclusion

The application of Web 2.0 concepts could significantly enhance the AEC collaborative design process. Through utilization of simple, accepted technologies rather than complex new systems barriers to entry are lowered. The Reasonate prototype will be test these concepts in practice to ascertain the effects of such technologies on the collaborative design process.

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