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Distributed and context-focused discussion on augmented documents and objects

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Abstract. We propose a combination of technologies for information encoding and for multimedia annotation to enrich interaction with paper documents and object labels, both in desktop and mobile settings. We argue that combining immediate access to online information from physical support with creation and retrieval of annotations, while keeping in focus the context of their creation, would increase awareness about products, processes and situations, and provide new ways of interaction based on tangible objects.

1 Introduction

Web-based documents are a way to distribute content among an arbitrary number of people, but their public nature does not make them a good candidate for cooperative discussion and development in restricted groups. On the other hand, email-based or forum-based discussions, even if restricted to stakeholders, are easily led astray by a lack of context, both physical and logical, necessary to keep them focused. Recent proposals such as GoogleDocs and GoogleWave, although effective in representing the evolution of a document or of a discussion, run the opposite risks of not making apparent which parts of the document need revision, or of disrupting the overall view of a discussion by presenting too many branches.

Moreover, in a ubiquitous perspective, differences in rendering, due to the heterogeneous nature of the interaction devices, do not guarantee that all users access the same presentation. This is particularly relevant when one wants to take advantage of the availability of information about concrete objects in everyday situations. We propose the combination of technologies for information encoding and for multimedia annotation, as a way to enrich interaction with paper documents and object labels, both in desktop and mobile settings.

The second author has patented the Cluster Pattern Interface (CLUSPI) paper-based technology (Kanev & Kimura, 2005, 2009): the physical support on which a document is printed is enriched with cluster patterns captured by a simple and usable input device (a scanning pen) and interpreted to provide contextual information (Kanev & Kimura, 2006). Typically, with each zone of interest a localization pattern is associated, so a user can receive zone-specific information.

We propose to extend this technology with the possibility of creating annotations on this content, accessible to any member of a collaborative group, thus relating each note to the context from which it originated. Moreover, threads of annotations can be created for one same context, either responding to an annotation, or creating a new one. Readers of a document could thus exploit several levels of reading: 1) reading the printed comment; 2) accessing additional information uniquely associated with parts of the document; 3) accessing annotations by other readers. These types of document usage do not interfere with each other, as one can choose which parts of this enriched content to exploit at any moment, and they are all accessible through specific supports.

The rest of paper proceeds as follows. We provide some additional information on the MADCOW system in Section 2 and discuss its integration with the CLUSPI technology in Section 3. Section 4 explores scenarios, both immediately realizable, and requiring simple extensions of the current capabilities of both systems. Finally, Section 5 discusses possible developments of the approach.

2 Annotation

We propose to exploit the existing MADCOW system, (to which the first author is collaborating), a system for annotation of Web content providing a uniform interactive approach to producing and using personal and public annotations on text, images and videos contained in Web documents within a standard browser (Bottoni, 2004; Avola 2010b). The client side exploits the bookmarklet technology, which is in principle platform-independent, barring differences in the Javascript interpreter. Currently, the MADCOW client is guaranteed to work with Mozilla Firefox, and tests are being performed on other major browsers.

In one of the scenarios discussed in Section 5, mobile access to annotations supports consumer-product evaluation and recommendation, so that a mobile browser version should be supported. For proof-of-concept experimentation, however, a Firefox browser on a small size netbook computer should suffice.

In a typical scenario, a user browsing a Web page can select any portion of text and click on the `PostToMADCOW` bookmarklet to open a pop-up window in which to enter the text of a note, give a title to the note, associate some tags with it and attach files in a number of formats. Metadata, such as the identity of the note creator, the creation date and a complete `XPath` description of the annotated interval of text, are automatically generated by the client, and the resulting *web-note* is posted to a MADCOW server. In a similar way, notes can be created for an image, or any area within the image, and for a video or any interval within it.

Existing notes can be explored via different mechanisms. Typically, a user visiting a Web page can inquire, through a `MADCOWNotes` bookmarklet, if notes exist for this page. The server will transmit information on all notes for that URL, and the client will highlight the annotated portions of text and mark the annotated images and videos. The user can access the actual content of the notes by clicking on the highlighted regions, and it will be presented in the same type of pop-up window, so that new notes can be added in the context of the previous ones. For complex notes, users can ask the server to generate a HTML page containing the web-note, so that this new page can be annotated in turn. Finally, users can access the MADCOW portal, to exploit its retrieval capabilities. For example, one can explore notes tagged with some set of terms, or created by some specific author or during some period. In general, several strategies of note exploration can be used, intermingled with normal browsing, within the same browsing session.

A *group* feature is being experimented (Avola, 2010a), where a creator makes a note public only to the MADCOW users registered to that group. Cooperative tasks can thus be based on MADCOW services, where users communicate by following threads of discussion on single topics, without having to set up elaborate schemes for securing the communication content.

3 The proposed architecture

Figure 1 illustrates the conceptual architecture for the proposed CLUSPI-MADCOW integration. A CLUSPI server maintains the relations between areas in a page and additional information, typically links to a HTML page. Additionally, the server is able to print, on normal paper, the unique patterns coding the information, and to superimpose the original content to them. A specialized portable scanner is able to recognize the patterns underlying significant areas and decode the link to the associated information. In a similar way, a MADCOW server is able to maintain the associations between HTML pages and web-notes on them.

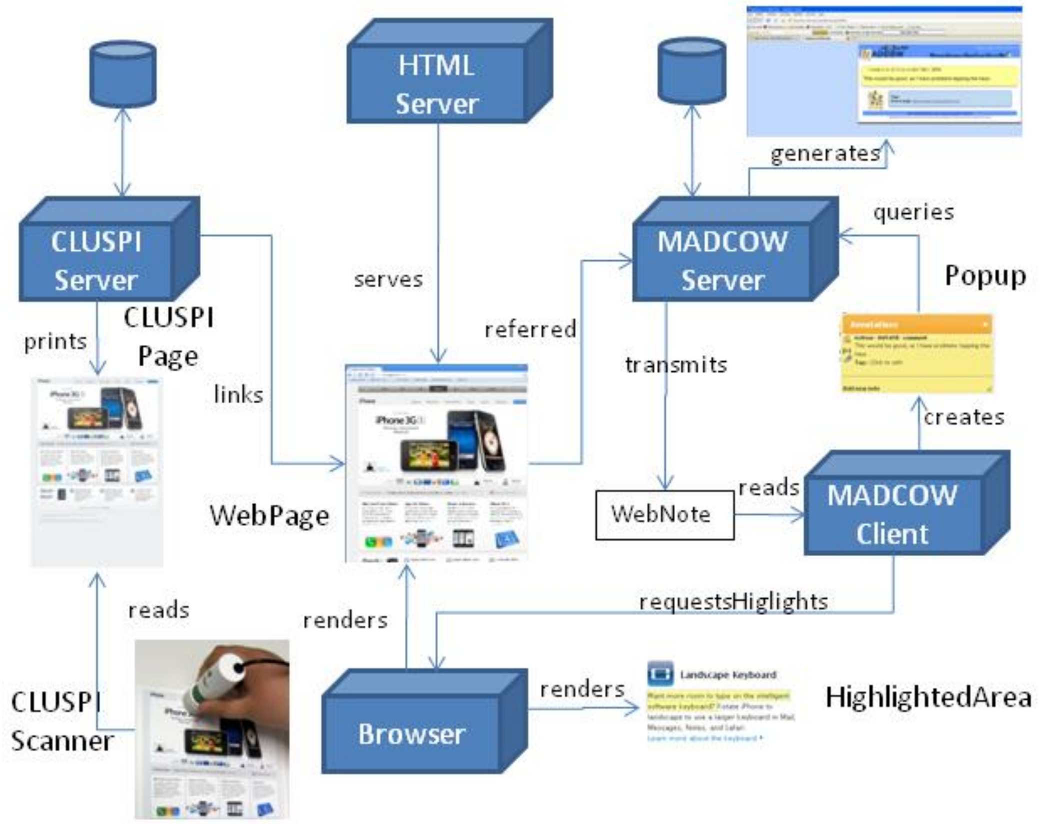

Figure 1. The conceptual architecture for the CLUSPI-MADCOW integration.

Moreover, it can dynamically generate new pages to present the content of an annotation. The MADCOW client, installed on the browser, communicates with the server to retrieve existing notes on the page visited by the browser, highlighting them in place. It also generates pop-up windows, which become the source for new interactions. The whole process is completely transparent to any HTML server whose pages are linked, either through notes or through CLUSPI patterns.

4 Usage scenarios

We consider here some scenario for the designed combination of the CLUSPI and MADCOW technologies, so that users can employ mobile devices for accessing online product information and related annotations in a self-explanatory way, while moving in physical contexts where the received information can be relevant. Using the camera function in the device, a customer can take a snapshot of a product or of its label, triggering an event to directly open a product-related information page in the browser on the same mobile device. This functionality is already widely available in Japan, where many products on the market have printed QR-codes. Other types of barcodes and carpet encoding schemes can be considered as possible interface options (see Dimitrov, 2009). However, QR-code and other barcode-based systems have some limitations, especially concerning the number of barcodes associated with a given product. It is thus difficult to establish multiple associations with existing online content and corresponding annotations for one product. On the contrary, the CLUSPI method allows the creation of 2D maps of product surfaces with a virtually unlimited number of associations to online digital information.

In general, any partial snapshot of a product surface would allow extraction of both the product identifier and the relative position of the user's camera with respect to the product surface. Thus, it can be used to pinpoint any particular feature printed on the product label. For example, a consumer wanting to know more about the sugar content of some food can point the camera to the printed line showing it on the product package. If more general information is needed, e.g. producer data and references, one can point at the company logo.

Moreover, customers could obtain instant access to the MADCOW annotation database - to retrieve annotations on the product web page - or to a dynamically generated page, containing annotations on the product.

A different family of scenarios regards cooperative activities which could employ a combination of these technologies, and the underlying distributed, context-focused discussion approach. For some participants, face-to-face meetings and discussions might be the best option. For other, distant participants, remote collaboration should be supported, while for participants with time constraints, time-shifted collaboration would be needed.

A key point is that even in a face-to-face discussion environment, collaborators would employ a browser-based interface for annotating collaborative activities. Such an activity is quite similar to the way we usually take notes and does not impose an additional burden to the participants while ensuring smooth note distribution and sharing among all participants. Hence, distant participants can get timely access to newly created discussion content for active engagement in collaboration activities. Time-shifted participants, on the other hand, can use the annotation repository to follow discussions and add their notes at a later time.

The tangible physical interface underlying the CLUSPI technology plays an important role in the cooperative process. Through it, collaborators separated by distance and time establish access to shared representations of physical artifacts subjected to a discussion. As an example, let us consider a discussion on a specific commercial product or a set of related products available at local stores. Participants in the cooperative activities are free to purchase product samples at different, maybe very distant, shops. The purchased products can then be used as a reference during face-to-face, remote, or time-shifted discussions. Products with digitally enhanced labels can be employed as tangible interface components for accessing and controlling the web-based annotation. In this way, MADCOW annotations can be mapped to different label surfaces and directly linked to specific features of concerned products. No label reprinting is needed as long as the printed content is preserved. Related annotations, on the other hand, will naturally change over the time as participants add and modify them interactively.

Other scenarios may involve content updates and reprinting, either occasionally or on a regular basis. A typical example is the product sales chain, where product information prepared by a producer and tuned by store marketing staff is supplied to customers. Such product information usually comes in form of brochures, information leaflets, website content, supportive audio and video, etc. Strong competition in the product sales chain forces the marketing staff to continuously update product information and develop new promotion materials. In big chain stores, product promotion strategies are often a cooperative effort of sales professionals affiliated with different stores at large distances. The scenario described so far clearly shows the need of cooperation in a context-focused discussion between different parties separated in space and time. Collaborative results of such cooperation are product marketing strategies and promotional content finally delivered to potential buyers in digital or printed form.

To engage our proposed method in the above scenario we start with uploading existing product promotional materials to a web server and thus making them accessible to all collaborators. Uploaded materials can be further interlinked to additional digital content available online. From this point on, different stores can independently create sample promotional leaflets by printing the content on the web server. With the embedded CLUSPI technology, printed leaflets also become a clickable interface to product related online content. We illustrate this in Figure 2, where a digitally enhanced printout of the main iPhone3G web page is shown.

For clarity we have added to the figure dashed rectangles in correspondence of the top tags in the page, together with four click sensitive areas linked to additional online content. The corresponding area titles and URLs in the original web page are as follows:

- “Why You’ll Love iPhone” - http://www.apple.com/iphone/why-iphone/
- “Apps for iPhone” - http://www.apple.com/iphone/apps-for-iphone/
- “iPhone in Business” - http://www.apple.com/iphone/business/

- "iPhone OS 4" - http://www.apple.com/iphone/preview-iphone-os/

The above URL addresses are accessible by simply pointing and clicking with a specialized CLUSPI reader on the printed sample page of Figure 2. The digitally enhanced printed page can be used as a template for showing digital content with the iPhone device itself, if an appropriate application is developed.

Figure 2. Information about a product with CLUSPI patterns in the dashed rectangular areas.

Through the MADCOW functionality, annotation-enhanced web pages can be created and printed. Such pages, in addition to existing web page links, will also contain links to various public and private annotations. Since annotation visibility depends on the currently logged user credentials, group membership, etc., different users could automatically get properly customized versions of the product promotional content. Such content can then be printed again for creating customized leaflets, different for each of the stores in the chain. As an example, Figure 3 shows a portion of the page accessed via the pattern associated with the Features tag at the top of Figure 2, where a user has added some annotation. The annotated text is highlighted in the Web page and the content of the annotation is shown in the pop-up window.

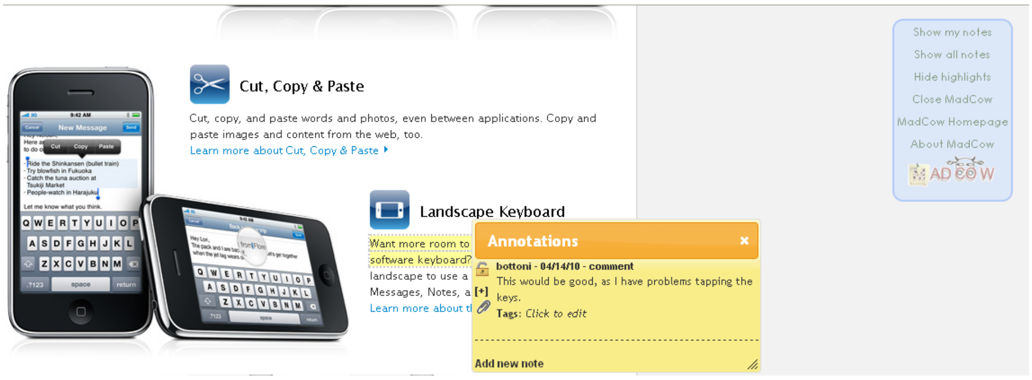

Figure 3. A note on a page accessed from a CLUSPI-enabled page.

In general, annotations can play different roles. On top of being a vehicle for distributed context-focused discussions, MADCOW–based functionalities can also support registration, management, and consequent access to independent product evaluations, recommendations, and user opinions. All such annotations can be accounted for in the printed versions of the product pamphlets through the embedded CLUSPI code. As an example, Figure 4 shows another page in the same website, where a user has added a comment to a previous note, providing a link to information relevant to the context, thus starting a focused conversation.

Additionally, specific product-related online sites could be accessed through a specialized MADCOW front-end, where customers can put and retrieve personalized annotations, or share comments, which can be made persistent and retrieved at any time, both in mobile and desktop settings. To further simplify customer input, one can adopt a menu-based product recommendation and evaluation interface that will further limit or even eliminate the need of typing.

The approach is potentially extensible to any kind of surface on which cluster patterns can be printed, embossed or engraved, thus giving access to information concerning tangible objects (Kanev 2008). The combination of these two technologies opens several scenarios for mobile applications. In particular, considering product evaluation, producers could use the cluster patterns to advertise their products and consumers could share and exchange opinions, express their (dis)satisfaction with the products, and/or recommend them. In (Dimitrov, 2009) the general issues of user awareness and mobility were discussed, and the major problems of mobile user access to product information outlined, adopting a client-server model for mobile access with Microsoft .Net Framework for the server-side.

Figure 4. A focused discussion on a product.

5 Conclusions

The “information overload” problem, even when filtering irrelevant or misleading information, is recognized as a serious problem to achieve the full potentiality of the Web. We need information which can be quickly found, easily understood and immediately used. In this direction, we have proposed the combination of two existing technologies, one for augmenting paper-based documents with access to digital information, and one for creating personalized and focused additional content to be shared with Internet users or within restricted groups, and we have shown several usage scenarios made possible by such a combination. We argue that combining immediate access to online information from physical support with creation and retrieval of annotations, while keeping in focus the context of their creation, would increase awareness about products, processes and situations, and provide new ways of interaction based on tangible objects.

In this sense, one interesting direction of development is the adoption of an open cross-media architecture, as advocated by Signer and Norrie (2009), where new formats can be readily managed, both as sources and content of annotations.

While the described scenarios can be immediately adopted by enriching existing content, the development and maintenance of active information resources should be jointly considered from very beginning. One way to guarantee quality and reliability of the information resources is to involve significantly sized groups of co-workers, collaborators, co-inspectors, etc in their development and maintenance. In a sense, a sort of open source development should be applied. Open annotation services are a promising technique to support such a style.

However, for each information resource some goals, orientations and corresponding guidance should be specified. In fact, this can also include specifications for cases with fuzzy goals, spontaneous and chaotic interactions to shape output, etc. In other words, the annotation service environment should integrate the Internet liberal behavior with some suitable rule and standard.

In particular, two levels can be envisioned for the specification of information to be retrieved, providing embedded clarity and applicability. The first, general level would be based on metadata descriptions, keywords, rules of digital libraries, semantic web relations, etc. The second, specific level can be based on multiple views of real object features, real-time communications between pieces of data representing the features, and locations of the data distribution.

Incorporating enhanced printed materials into "clickable" interface panels of web-based tools would introduce a new environment to support more direct relations of real and virtual world objects and to engage collaborators not only in the discussion of object features, but also in specific, practical decisions. It would also be a basis for creating information resources representing real object features and for immediate usability tests of the resources.

6 References

Avola, D., Bottoni, P., Laureti, M., Levialdi S., and Panizzi, E. (2010) "Managing Groups and Group Annotations in MADCOW", *Proc. DNIS 2010,* LNCS 5999, pp.204-219.

Avola, D., Bottoni, P., Levialdi S., and Panizzi, E. (2010) "Interacting Annotations in MADCOW 2.0 to appear in *Proc. AVI 2010*.

Bottoni, P., Civica, R., Levialdi, S., Orso, L., Panizzi, E., and Trinchese, R. (2004) :"MADCOW: a Multimedia Digital Annotation System", in M.F. Costabile (ed.): *Proc. AVI 2004*, ACM Press, pp. 55-62.

Dimitrov, K., Kanev, K. and Kimura, S. (2009): "Product Recommendations in Mobile Environments", *Information Technologies and Control*, vol. 7, no. 3, 2009, pp.10-14.

Kanev, K. and Kimura, S. (2005): Digital Information Carrier, JP, Patent No 3635374.

Kanev, K. and Kimura, S. (2006): "Direct Point-and-Click Functionality for Printed Materials", *The Journal of Three Dimensional Images*, vol. 20, no. 2, 2006, pp. 51-59.

Kanev, K. (2008): "Tangible Interfaces for Interactive Multimedia Presentations", *International Journal of Mobile Information Systems*, Vol. 4, No. 3, 2008, pp. 183-193.

Kanev, K. and Kimura, S. (2009): Digital Information Carrier, JP, Patent No 4368373.

Signer, B. and Norrie, M. C. (2009): "An Architecture for Open Cross-Media Annotation Services", *Proc. WISE 2009*, LNCS 5802, pp. 387–400.