

WebStickers: Using Physical Objects as WWW Bookmarks

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ABSTRACT

We describe a low-cost distributed method for associating web pages with physical objects, thus making the objects act as physical bookmarks to the World Wide Web. By doing this, we can inherit the physical properties of the objects, such as persistency and availability. The system utilizes stickers with pre-printed barcodes – *WebStickers* – to associate URLs with physical objects. Users can return to a desired web page by scanning the barcode attached to an object. The associations are stored in a networked server, making it easy to move and share physical bookmarks between users. Preliminary evaluations show that the system is easy to use, even for novice users.

Keywords

World Wide Web bookmarks, augmented reality, barcodes

INTRODUCTION

Bookmark lists, also known as hotlists or favorites, are currently the dominating approach to managing URLs [1]. However, traditional bookmark management has several drawbacks. It is easy to create new bookmarks, but it takes more effort to organize them and typically only a fraction of the bookmarks are frequently used [1]. Depending on the time that a particular URL is interesting, bookmarks can be divided into three rough categories: short-term or *ephemeral*, *working* and *archived* [2]. Bookmark lists tend not to be used for short-term bookmarks, because it takes too much effort to manually delete unwanted bookmarks [1]. Further, since the bookmark file is normally tied to a single computer, it is not convenient to take it with you somewhere else, or to share bookmarks with others. Finally, bookmarks are created in a certain context, but that context does not fit into the limitations of a traditional bookmark list, and adding and accessing annotations can be cumbersome.

Virtual and physical spaces

Recent research on the integration of information and physical spaces [3, 4] has inspired us to take advantages of the properties of physical objects. A recent example of using physical objects as controls for digital information is *mediaBLOCKS* [5]. However, that system required custom hardware that was relatively costly and hard to move around, and we wanted to develop an alternative that used a simpler technique. We wanted a simple, low-cost technique for using common physical objects as bookmarks to web pages.

WEBSTICKERS

We chose to base our system on ordinary printed barcodes. Barcodes can easily be produced with standard printers using readily available software. Inexpensive off-the-shelf hardware can be used to enter a barcode into a computer, and paper-based objects with barcodes can easily be copied and shared, e.g. on business cards, handouts or commercials. Most barcodes also have the advantage of being usable even when no dedicated reader hardware is available, since typing in the barcode number by hand will always work, although it requires more effort from the user.

Our system lets users attach a small sticker with a pre-printed barcode – a *WebSticker* – to any object, and then associate the barcode to one or several web page URLs.



Figure 1: Post-It note with WebSticker

Users can then return to the web page by picking up the object and entering the barcode into their computer with a barcode reader. WebSticker-augmented objects can be annotated and organized in the real world, thus providing the user with various cognitive cues to the corresponding web pages. Users are provided with sheets of pre-printed barcode stickers with unique numerical IDs, which are used as keys in a networked database. Since the system is networked, tagged objects can be shared between all users and brought anywhere.



Figure 2: The WebStickers window.

Software Interface

We are using a server, connected via the Internet to client PCs, with off-the-shelf barcode scanners connected through the keyboard cable. The PC program has an input window for entering barcode numbers and a command button that can switch between three modes: *Goto*, *Store* or *Add* (Figure 2). *Goto* is the default mode. In this mode, when a barcode is scanned the system fetches the corresponding URL from the networked database and

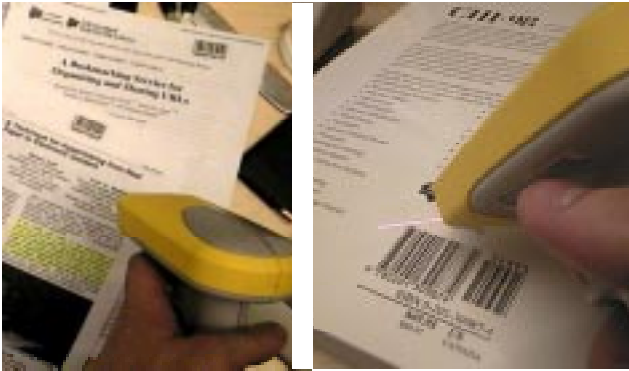


Figure 3: Using WebStickers and existing barcodes

displays the corresponding web page in the browser window. If several URLs are associated with a single barcode, the system displays a list of hyperlinks. The *Store* mode is used when creating new associations, or when replacing old ones, and finally *Add* is used to add more URLs to an existing entry. When scanning a barcode in these two later modes, the program asks the web browser which page is currently active, and its URL is associated with the barcode ID in the networked database.

USING OBJECTS AS BOOKMARKS

For *ephemeral* bookmarks, we have been using Post-It™ notes with pre-printed barcodes (Figure 1). The notes have a sufficient area for the user to write some text explaining what the bookmark refers to. This makes it natural to use them as transient notes, that are used only for a short time or passed on to other people. The notes also have an advantage in the built-in aging process: After a while the glue loses its strength, and the note stops sticking to the surface where it was attached. This puts a natural limit on how long a note will exist, and users can then choose to either make a new note or to transfer that bookmark into their traditional bookmark file.

WebStickers are easily attached to *working* documents, e.g. articles printed from the web (Figure 3, left). They can be associated with the URL where they were found, but when the article is read and references are followed up, these too have a natural association with the original document and can subsequently be associated with the same physical paper. When a particular project is finished, the working documents are not used frequently anymore and hence turn into *archived* objects that can be used for reference later.

For bookmarks that are expected to have a long life or being frequently used other objects can be used. A familiar object can be tagged with a WebSticker, providing context and cues that reminds the user of a particular web page. For instance, during the evaluation one user felt that a souvenir mug bought at the SIGGRAPH conference had a natural association with the ACM SIGGRAPH association. By attaching a WebSticker to the mug, the user could make the mug act as a physical bookmark to the ACM SIGGRAPH website.

Finally, many objects already have barcodes, making it unnecessary to attach a WebSticker. For example, most

books and magazines have ISBN or ISSN numbers as barcodes, and almost everything bought in a store has a UPC or EAN barcode. If for instance a user wants to associate a particular book with a website, the pre-existing printed barcode allows her to associate that book to the website with no modification of the physical object (Figure 3, right).

PRELIMINARY EVALUATIONS

We let several people use the system for a day or two each. In general, even novice users found the system easy to learn and use, and initial impressions of the system are very promising. The informal evaluation also led us to implementing several improvements. Initially each barcode was associated with a single web page, but we soon found the need to make it possible to associate more than one URL with each sticker, as described above. We also implemented some changes in the graphical user interface where users control when bookmarks are entered and retrieved, making the system work more smoothly than before the evaluation.

DISCUSSION AND FUTURE WORK

More evaluations of the current system should be performed, to determine which areas need improvement, in particular the methods to introduce association and look up web pages. Studies should also be made to determine in what ways, if any, physical bookmarks offer advantages over traditional bookmark systems, and what types of objects are suitable for use as bookmarks.

Developing the technical aspects of the system is also important, and it might be considered to move from current barcode tagging to some other tagging system. Using some form of electronic tagging system would mean that every object had to be explicitly marked, losing the possibility of using the barcodes that already exist on many objects. On the other hand, other types of tags might make it possible to enter the identity of an object in a more natural way, for instance by just "showing" an object to the computer.

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