
RealFind: Managing Personal Items in the Physical World

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Abstract

While in recent years some effort has been put into helping users manage their personal information in their computers, little has been done to provide meaningful ways to organize and retrieve a user's personal physical objects. Nowadays, technologies such as RFID tags can help bridge the gap between the real and electronic worlds. We propose that a tool that keeps track of the users' objects and seamlessly inter-relates information about them with other relevant autobiographical and contextual data, about the users and their activities, can help manage and retrieve both physical and electronic items in meaningful ways. We describe a prototype tool, RealFind that allows this to take place in a synergistic and effective way. Objects can be searched for based on their properties, but also by relating them to a wide range of contextual information stored on their computers.

Keywords

Physical Object Retrieval, Personal Information Management, Document Retrieval

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ACM Classification Keywords

H.3.3 Information Search and Retrieval: Query formulation, I.3.6 Methodology and Techniques: Interaction Techniques, H.5.m Miscellaneous.

Introduction

Finding the different pieces of personal information scattered throughout our computers is not an easy task, and it becomes harder as their number and that of different applications that manage it grow.

Recognizing this fact, several researchers have, in recent years, tried to create tools and techniques that allow users to more easily manage that information. However, little has been done to help them manage their physical objects.

Until recently, the existing physical location technology did not allow practical and realistic scenarios to be considered. Systems such as CyberCode [6] and Trip [3] use 2D barcodes to identify items. While barcodes are cheap and easy to use, it is necessary for them to be visible in order for the objects to be recognized, seriously limiting the scenarios in which they can be used. Furthermore, fairly sophisticated computer vision algorithms must be used to cope with different lighting conditions when identifying objects. Ultrasound-based approaches, such as Active Bat [1] and Cricket [5], use ultrasound beacons to determine a position. Those beacons are usually large and too expensive to be attached to objects on an individual basis.

Recently, RFID technology has become increasingly widespread. RFID tags are small, flexible and inexpensive, making it possible to attach them to all kinds of objects. No line-of-sight is required to read them, and this can be done regardless of environment conditions (in normal home or office settings). Some works have successfully used them to track personal objects. The Max system [8] allows users to search for their objects in ways that are meaningful to them ("a book near the bed in the bedroom"). Magic Touch [4]

assumes a small RFID reader is attached to the users' hands, thus automatically recording everything they touch and move. The 3D-ID system [7] is a more sophisticated, building-wide, location approach.

What all the above approaches lack is a way to inter-relate the physical objects and their locations with other, relevant, contextual and autobiographic information about the users and their activities. Their sole purpose is to keep track of the objects' locations. This disregards a wealth of data, significant to the users, that can be gleaned from their computers. Often, the activities in the real and virtual worlds are connected. Those connections should be exploited in rich, synergistic ways. The users' agenda on the computer can help them know when an item was last handled ("where is that book I got as a present for my birthday?"), as can the users' emails and documents ("where is that CD I bought after a recommendation by Jack?"). Also, users might associate objects with their activities ("I bought this shirt when I was preparing to present my dissertation. Where is the document I wrote at the time?"). In short, the users' lives take place in both the real and virtual realms at the same time, and it is important to consider personal items from both domains in an integrated way.

We present RealFind, a prototype system that continuously collects context-based information about the users' interactions with their computers and objects in the physical world, and allows them to browse all information in an integrated way, supporting rich interaction scenarios. We will succinctly describe how that monitoring takes place, and the RealFind interface, highlighting relevant usage scenarios it supports.

Managing Physical Objects

To be able to use information about the users, their activities and their objects, that information must be collected. To do so, we created a plugin-based automatic system that continuously monitors the users' computers and records their activities. All documents and related meta-data are stored, as are the emails sent and received (and the attachments therein), web pages visited, the users' address book, and so on. All this information is updated in real time. Instead of storing the data in a database, a knowledge base is used. This allows rich inference rules to be evaluated, thus interconnecting data from different sources in meaningful ways.

To gather information about the users' physical objects, the monitoring system resorts to a special-purpose plugin that collects data from different RFID readers, each associated to a specific physical location. The plugin manages a list of all known objects. Whenever a new object appears, the user is prompted by the system to describe it. This can be done by filling in a form for the object, or by example, by telling the system that the object is another of a given kind (a new pair of socks, for instance). In this case, data characterizing the object (such as its type) can be automatically inferred from the one regarding the similar ones. The plugin keeps track of objects moving from the range of one reader to another's, updating their location accordingly. A special reader represents the "garbage-bin", where objects that should cease to be monitored should be placed in that eventuality.

In the special case of paper documents, more information can be automatically inferred if the document has been printed by the user. A printer-

monitoring plugin detects when a document is printed and asks the user to associate a tag to that document. This allows the system to keep track of printed versions of documents. All meta-data and contextual information regarding the electronic document is, thus, transferred seamlessly to its printed copy: they are considered to be two different facets of a single entity [2].

RealFind

Our prototype system, RealFind, accesses the knowledge base updated by the monitoring system and allows the user to browse all the data therein, in an interconnected way.

When the application is first launched, it presents the user with a tag cloud for the keywords present in the user's personal information, regardless of their source: annotations about physical objects, email messages, documents, etc. (figure 1). This allows users to jump directly to a list of items for which that keyword is relevant. Those items can be virtual or physical, as RealFind makes no distinction between them.

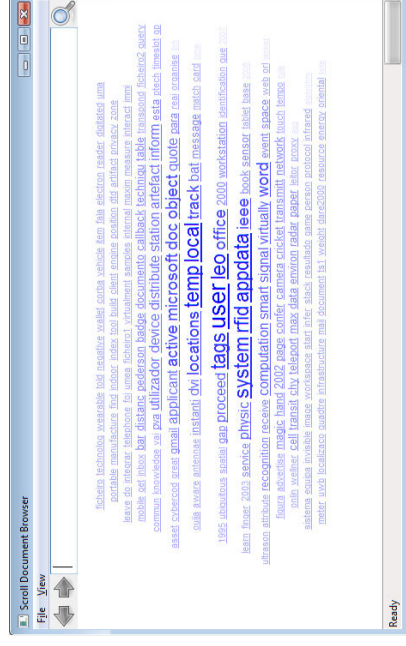


figure 1. RealFind's initial screen.

It is also possible to use the search box at the top of the screen to look for items that match certain criteria. This includes keywords, dates (items handled around that date are shown), person names (displays a list of appointments or emails exchanged with them), or pathnames (shows all files in that location).

The main screen for RealFind, where the browsing is performed, can be seen in figure 2. A list of items is shown and can be browsed to find a specific one. For each item, all relevant details are displayed. As these change from item to item, the interface is organized as

a set of views. Each view is specific for a kind of object. The one depicted in figure 2 is the Document View. In figure 3 it is possible to see a Date View, in which all documents created and modified, and emails sent and received in a specific date can be seen. Others are the Email View, Person View, and Physical Location View. The navigation between views can be performed by clicking on the different information elements for the items displayed at the time. For instance, clicking on a document's creation date jumps to the date view, where all items handled around that date are shown. This supports the iterative exploration of a user's items.

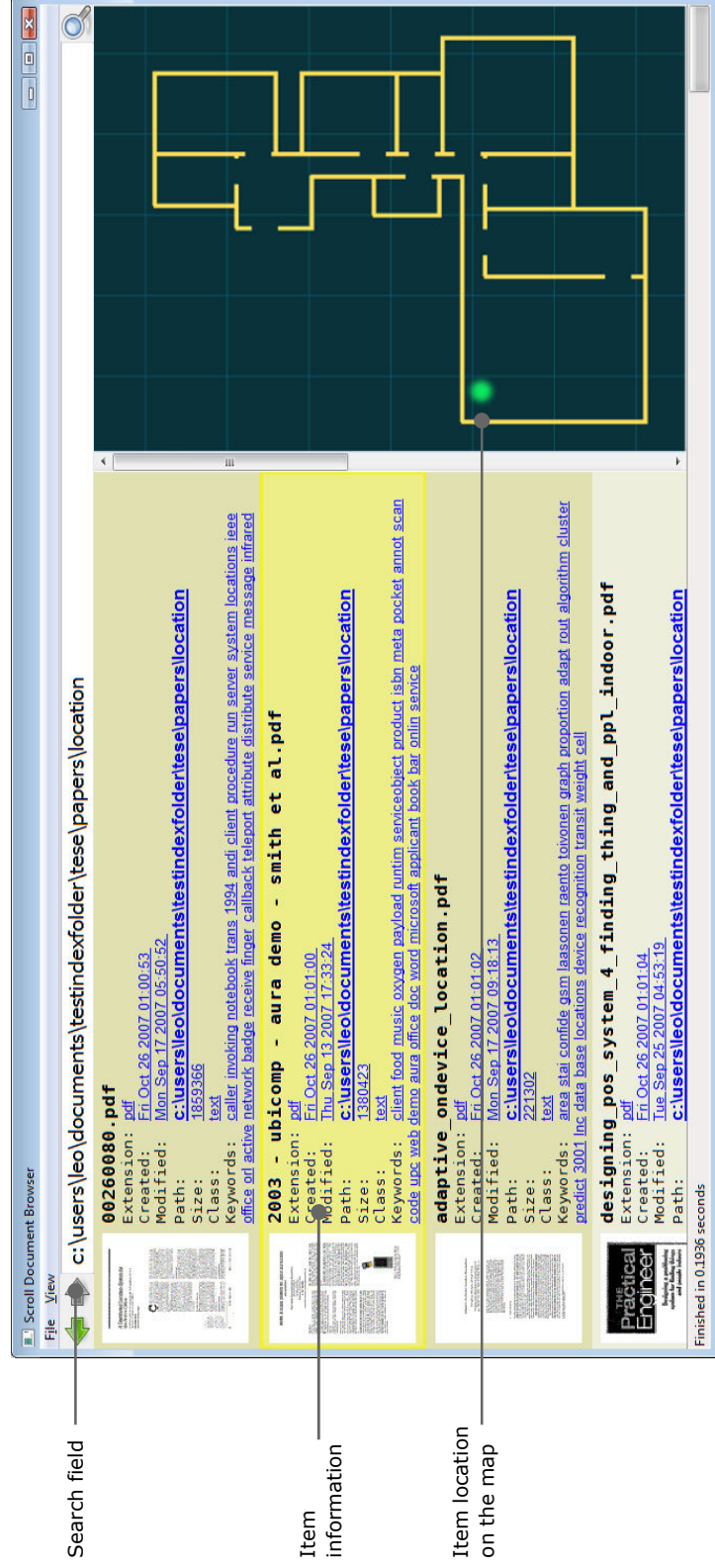


figure 2. The RealFind Interface, showing the physical location of some documents.

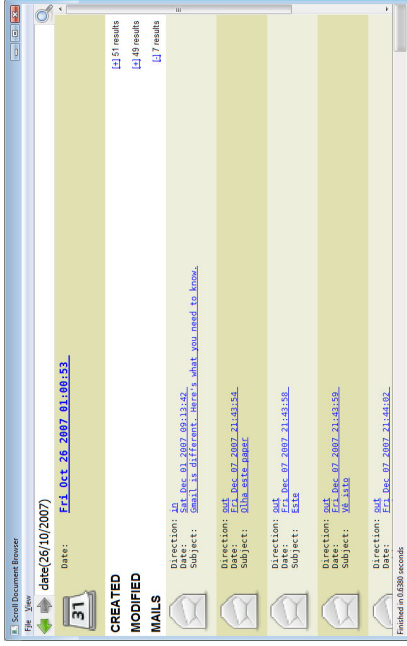


figure 3. RealFind's Date View

Also, it is possible to enter constraints into RealFind, restricting the list of items in each view. This is done by control-clicking on an information element. From then on, only items that satisfy that constraint will be shown. For instance, control-clicking a date will result in only items handled around that date to be displayed.

To the side of the main browsing window is an interactive map. It shows the physical location of the selected item(s) in the browsing window, and can be used to easily find them. The opposite is also possible: clicking on a location in the map results in a list of items in that location to be displayed in a physical item view. Control-clicking will enter that location as a constraint.

Usage Scenarios

RealFind allows users to manage their items in rich ways. Here we describe the more meaningful ones.

PHYSICAL VERSIONS OF ELECTRONIC ITEMS

As described above the physical and electronic versions of printed documents are seen as different versions of the same item. As such, it is possible to easily find a paper document from its electronic counterpart (selecting it in the document view highlights its location on the map), and vice-versa (bringing a paper document close to a special-purpose reader will result in its electronic counterpart appearing in RealFind).

PHYSICAL OBJECTS AS SHORTCUTS TO VIRTUAL INFORMATION

Since all information is interrelated, it is possible to select a specific physical object and, browsing in RealFind, find all relevant information about it, but also about emails around the time when it was handled, etc. For instance, if the physical object is a book or DVD, it is possible to find all documents the user wrote about its subject. The reciprocal is also possible (finding all books bought when preparing the classes about a particular subject, for instance). This scenario also allows for interactions such as finding an mp3 file that is part of the soundtrack of a particular DVD stored in the living room, or the code samples that came with a particular computer science book.

PATTERN DISCOVERY

RealFind is able to provide the user with suggestions based on patterns it detects in the information. For instance, it suggests a location for a newly found item based on the locations of others of the same type (all socks go into the sock drawer, for instance). Also, if all documents and books on a given subject are in a particular shelf, this will be suggested as the location for a newly printed document sharing that subject.

The suggestion of potentially interesting documents or web pages based on the users' tastes, inferred from their books and DVDs is also possible. Finally, RealFind can help users manage their storage space by detecting objects that might be out of place or that have remained for a long time away from their usual storage location, reminding users to put them away (and where to do so).

Conclusions

The actions of users in the real and virtual worlds are often interconnected. Information gleaned in one can and should be used in the other. The synergies this allows will help users to cope with their environment growing complexity. Our prototype system, RealFind, provides a way to integrate all information about the users' items, real or not, helping them to manage those items in efficient ways.

In the future, we plan to extend RealFind to support other usage scenarios. We will perform user evaluation to verify the system's adequacy. Also, it will be interesting to see in what other ways can the system act proactively, pointing out relevant information about the users and their items. The extent to which this might help users will be studied.

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