

A ENCCON Visual Browser for Large-Scale Online Auctions

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Abstract

The Internet has dramatically brought more and more together buyers and sellers to the electronic marketplaces. Despite a rapid growing of interest and researches on the internet-based online e-commerce systems, the design of efficient mechanisms for navigating online product catalogs is still quite limited, especially for online auctions. This paper describes an interactively visual interface for navigating product catalogs of large-scale online auction sites. We use the ENCCON layout algorithm to display the entire, as well as a portion of product hierarchy. The display of the hierarchy is accommodated with a focus+context viewing technique for moving the interesting focus of users around the product hierarchy. We have developed an online auction prototype to simulate the ordinary auction activities with the assistance of proposed ENCCON visual interface.

Keywords: Online Product Catalog, e-Commerce, Online Auctions, Navigation, Information Visualization.

1. Introduction

Over the past few years, electronic commerce (or e-commerce) has emerged as a dramatic new mode of business [1]. One of the greatest potentials of e-commerce is its ability to bring the effectiveness and unprecedented massive scale of buyers and sellers from all over the world. This property benefits both sides that the buyers might have greater product diversity with potentially lower prices, and the sellers are able to reach a greater numbers of potential customers [4]. At any time, through the online shopping stores (or auction sites), customers can learn more about the products, buy goods with electronic cash, and even have information goods delivered over

the network. On the other hands, suppliers can reduce the overhead costs by investigating less in physical stores and distribution channels [6].

An important precondition to the success of e-commerce systems, or specifically online auctions, is the construction of appropriate customer interfaces, from which an online product catalog can be retrieved, is one of the key elements. There are many extensive research works have been done on both components of the online product catalog: 1) the content management and 2) the catalog interface. For content management, a number of products have been developed and used at commercial website such as *CardoNet*, *Interwoven*, *OnDisplay*, *Poet Software*, *Vignette*, etc [10]. For catalog interface, there are various methods that can support product search and navigation have been developed [3] [5].

Currently, the majority of the commercial auction sites provide users with both the basic click-through navigation scheme, which is based on HTML pages, tables and lists, and add-on navigation aids. The add-on navigation aids aim to provide navigation functions customizable to each user's need, such as search engines, and personalized recommendations. In addition, multiple views of lists are usually used for the ease of seeking interested items. These views include *Current* (i.e. the default view of all items), *New Today* (i.e. the new items posted today), and *Ending Today* (i.e. the items ending today), etc.

Although the available navigation techniques can effectively assist sellers/buyers in searching and accessing product information over the World Wide Web, they mostly use the text-based interface that allows users to navigate by clicking-through several pages via URL links. Thus, it is difficult for the users to percept the overall structure of the product hierarchy by reading these textural lists. Figure 1 shows an example of a text-based interface that is used on *eBay's* online auction website [13] for browsing the product catalog.

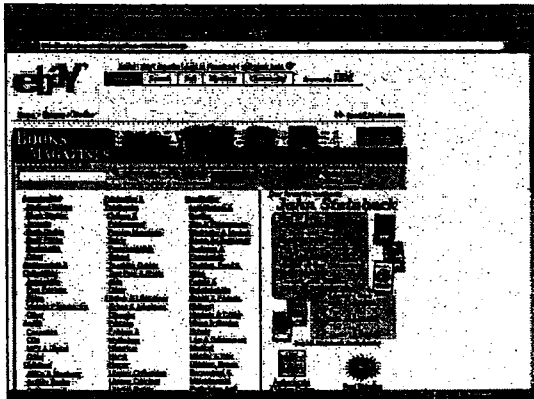


Figure 1. An example of a text-based interface for browsing an online auction's product catalog.

Some newly developed visualization approaches have been proposed and implemented to address the above problem and to enhance the presentation of product hierarchies for navigation. They aim to improve the readability, understandability, and comprehension of hierarchical structure behind and to reduce the cognitive overhead and time consumed on understanding the structure. These techniques mainly apply 2D graph/tree visualization techniques to display and navigate the product catalogs. The technical detail of these visualization techniques can be found at [5], [8], [12]. However, there is little research on the visual navigation of online auctions.

In this paper, we describe a new visualization approach for navigating large-scale online product catalogs of online auction stores. The visualization technique is based on the ENCCON model [9] that displays the entire product hierarchy as well as a small portion of user focused sub-hierarchy. We also provide a focus+context navigation technique allowing users to browse through the entire product catalog. We developed a prototype of an online auction store to demonstrate the effectiveness of our visualization technique in the area of online auction.

2. The Framework of Visual Online Auction Store

The proposed *Visual Online Auction Store* is made of several components. With in the scope of this paper, we concentrate only on the navigation component of the online auction. Figure 2 shows the components and interconnections among them in the context of online auction.

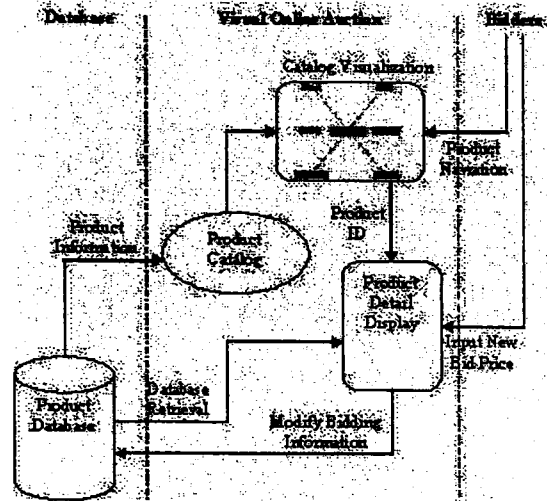


Figure 2: The framework of an online Auction store (the navigation part).

- **Product database:** a relational database used to store product information, including all data fields, attributes, and bidding information associated with a particular product that is available for auctioning. We use a MySQL database in our implementation.
- **Product Catalog:** a content management system that assembles, indexes, aggregates and normalizes product information from the product database, and quickly distributes the product catalog information.
- **Catalog Visualization:** a visual navigational interface that automatically displays the entire product catalog's hierarchy, including categories, subcategories, and products. This component applies a Focus+Context visual navigation mechanism, called ENCCON [9], allowing the bidder not only to view the entire product hierarchy, but also to interactively browse down to a particular auctioned item.
- **Product Detail Display:** a web page generated on the server side by a particular scripting language, PHP in our implementation, to show all the appropriate information of the selected product. This page also displays the product's bidding information, and it allows the authenticated bidder to input the bidding price for the product.

3. Dynamic Visualization of Online Auction's Product Catalog

The visualization of the product catalog for online auction is implemented using JavaApplets. The applet retrieves and updates information from the database via PHP programming language. This visual browsing window does not aim to replace entirely the traditional text-based interface, but it does provide extra assistance to the users. In addition, the size of this applet window can be adjusted to suit each user's preference.

We use ENCCON - a new hierarchical information visualization technique [9], to represent the structure of the product catalog. In ENCCON visualization, *nodes* are used to represent the objects (such as categories, subcategories and auction items), while *edges* are used to present relationships among the objects or the relations among auction items and the categories.

There are several alternative approaches in the design of navigational structure for online auction sites. The navigational structure can be either a

breadth-oriented or a depth-oriented. The breadth-oriented structure has the advantage of guiding users to his/her target item with the minimised number of the mouse clicks, while depth-oriented structure enables the user to browse through more specific subcategory of interesting items effectively. However, the depth-oriented navigational structure requires more intermediate levels of retrieval [4]. Although the use of appropriate navigational structure is purely depends on the nature of applications, our auction prototype system uses breadth orientation in its implementation. On the other hand, the navigational structure can be either single-only or multiple hierarchies. The use of multiple hierarchies may increase the chance of locating a target item of interest, but it often confuses the user because of its inconsistency through the site. The navigation structure used in our implementation is a single-only hierarchy.

The optimized layout algorithm was chosen and used in our implementation to take its advantages of geometric space efficiency, fast navigation, and aesthetically nice. The above features and advantages

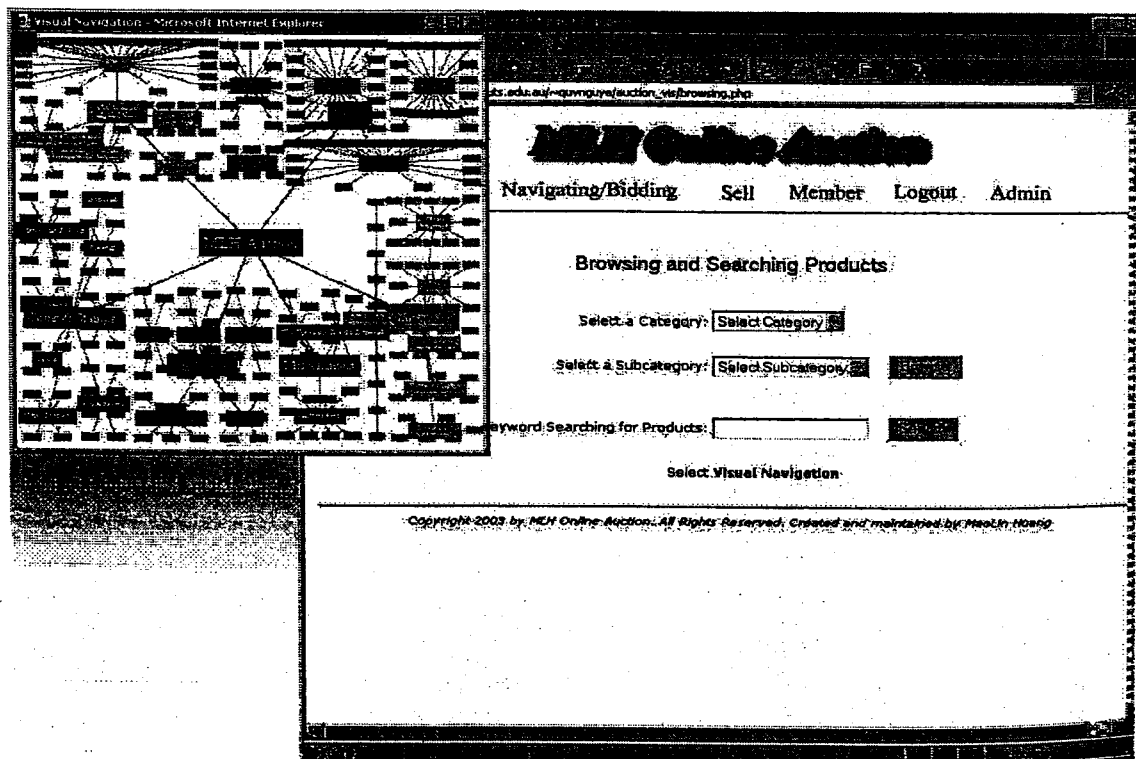


Figure 3. An example of the navigational window and the main window of the online auction

of our layout technique ensure the capability of handling large or very large scale visualization with several levels of hierarchical views, i.e. a complex online auction's product catalog with thousands of auction items. In other words, this improves the scalability of the traditional interface. The ENCCON technique also provides an overview of the entire category. This helps users to have a better understanding of the overall structure of the product catalog. Figure 3 shows an example of the visual navigational window (that displays all categories, subcategories and auction items) and the main window for browsing online auction's product catalog.

We use a focus+context viewing technique for the navigation of hierarchy. In the visualization, we overlap the layout of overall context to the layout of focused sub-hierarchy, with the semi-transparency technique to display these dual views in the same geometric area, in which the focused sub-hierarchy is called the *detail-view* and the context of the hierarchy is called the *global-view*. This allows users to explore through entire hierarchy quickly by moving around the sub-hierarchies. Each visual interaction is accommodated by an animation in order to preserve the mental-map of the user during the navigation. In more detail, there are two states of the visualization: *normal* and *history*. In the *normal* state, the user's attention is on a particular sub-catalog from the *detail-view*, and when the *history* state turns on, the user's attention moves to the content of the *global-view*. At the *normal* state, the selected sub-hierarchy is displayed with no transparency, while the context is partly transparent and is displayed in brighter colour (see Figure 5). At the *history* state, the context is brought from the back to the front and displayed with no transparency, while the detail information is sent from the front to the back and displayed with brighter and partly transparent colour (see Figure 6). These two views can be shifted interactively by using left mouse-click on the background of each layer.

The visualization uses different colours to present items and subcategories of different categories. The categories and subcategories are also presented with bold boundary to identify auction items with the domain. These displays aim to improve the clarity of the visualization. The system also provides a mechanism to highlight the *new products*, *ending-today products*, etc. This aim to improve the overall display where the users can easily find the special items through the product catalog (see Figure 4). We also provide an interactive menu allowing users to adjust the display to their preferred styles. When the

mouse is moving over a node, the sub-hierarchy of the focused node is highlighted to emphasize the selection (see Figure 4). In addition, if the focused node is an auctioned item, brief information will be displayed. This aims to reduce the navigation time since the users can quickly view information of the item from the visual navigation window. In our prototype, this brief information includes *current bid price*, *starting date* and *closing date* (see Figure 7). Finally, from the focused item, the bidders can also double-click on a particular product node in order to display all information associated to that auction item at the main window (see Figure 8).

Figure 4 shows a global view of the product catalog of the prototype system: MLH Online Auction. From this figure, we can quickly identify two *new products* (at Antiques-Glassware, and Computers-Software categories), these two items are highlighted by painted with darker color at the front. This figure also indicates that the user is focusing on the category "Computers". Figure 5 shows the next display when the node "Computers" is selected. You can see from the display of Figure 5 that the subcategories and product of the category "Computers" are enlarged and occupying the entire screen, while the previous context view in Figure 4 is reduced and sent to the background with semi-transparency. Figure 6 is the display when the *global-view* active state is selected. You can see that the display is reversed that the context is brought from the background to the front and displayed with full colours, and the *detail-view* is sent from the front to the back and displayed with semi-transparent colours.

4. Conclusion

We have presented our information visualization component ENCCON Visual Browser that appears as an additional window, and can be used for assistant of online auctions. This visual component enables users to view and brows the auction catalog with large number of the auction items. We employed an new context+focus viewing technique called *semi-transparency* to handle the overlapped display of both the context view and the focus view. The combination of optimised ENCCON layout and the *semi-transparency* viewing provides users with a visual aid for the fast and effective product navigation. Although this project has not been completely finished, we believe that this technique is very valuable for quick navigation, and also for improving the understanding of users to the auction product categories.

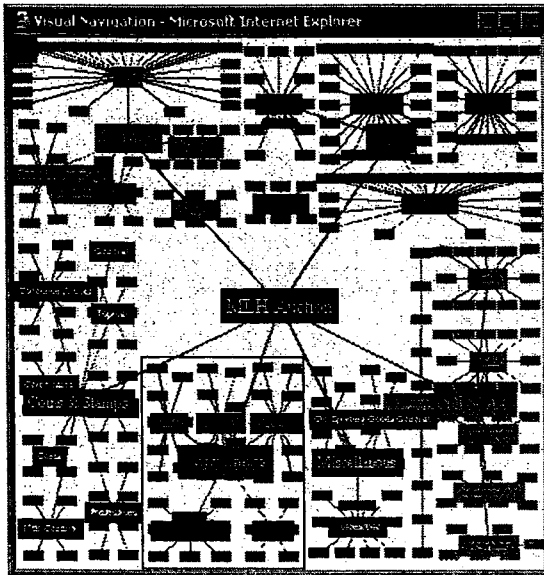


Figure 4. The global view of the entire product catalog.

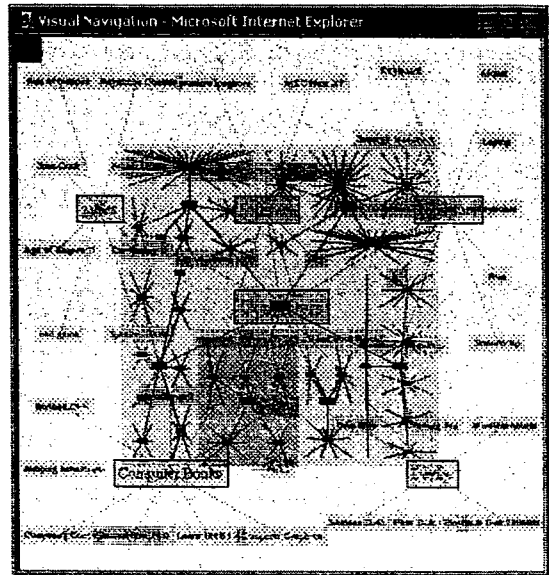


Figure 6. The display when the *global-view* active state is selected.

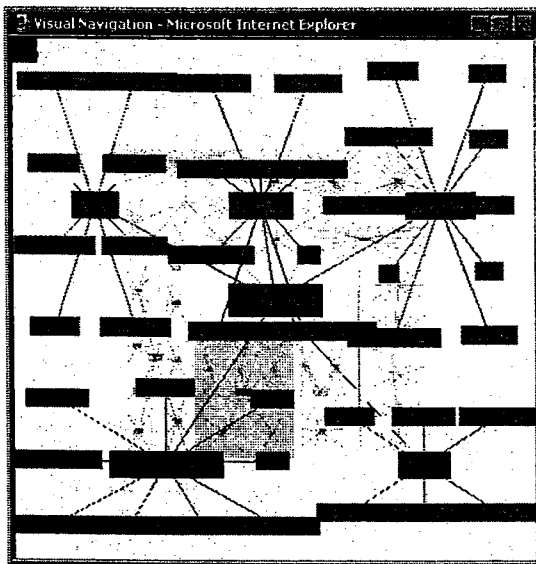


Figure 5. The display of all subcategories and auctioned items belonging to the category "Computer".

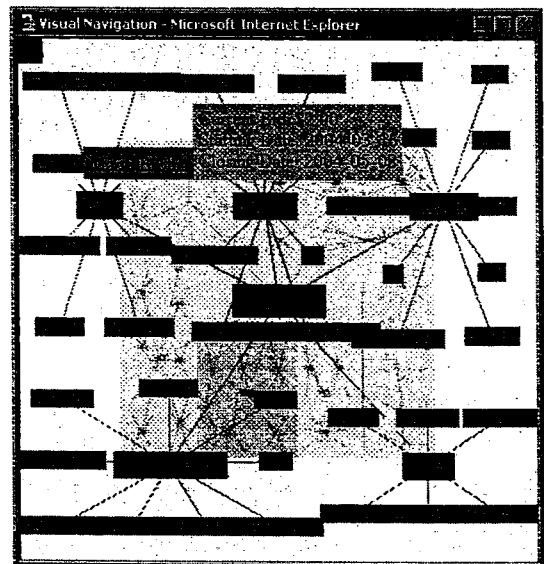


Figure 7. The display when the mouse is over a product. The system pop-ups a layer to show more detail of the auctioned item.

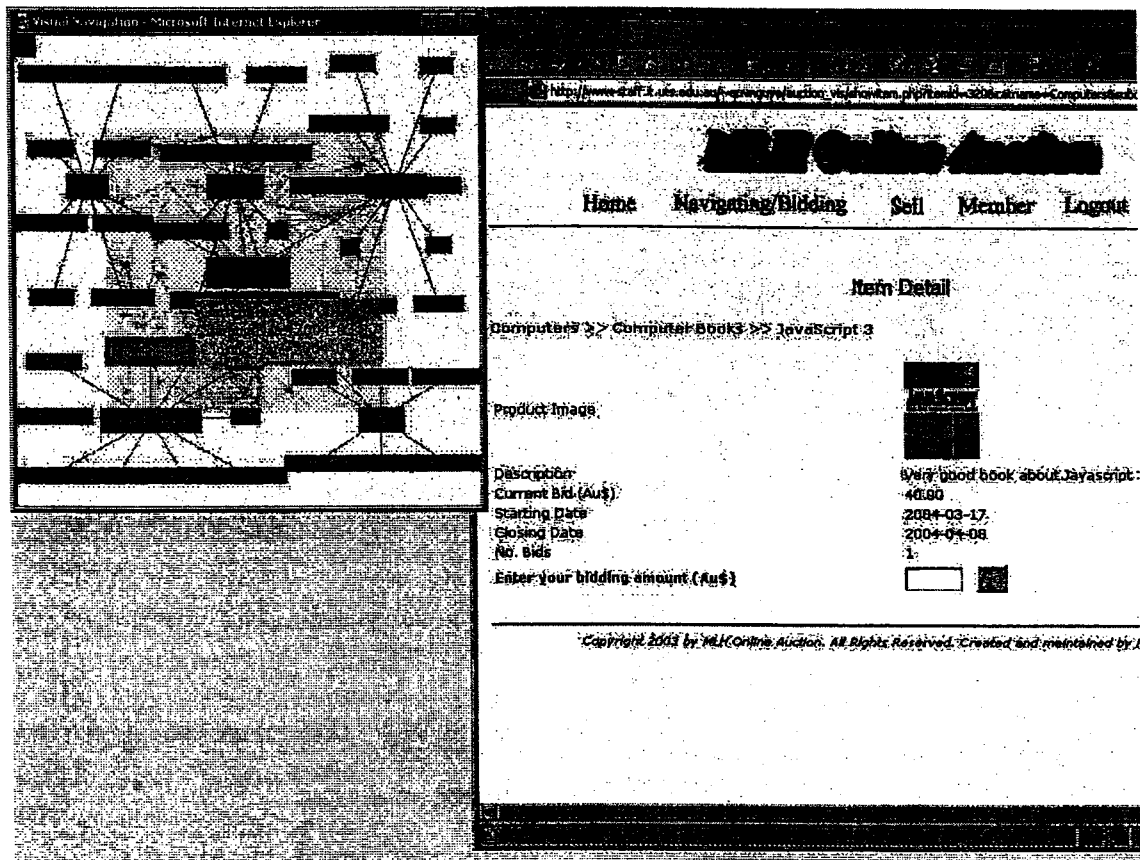


Figure 8. An example of the display of both visual navigation and the main window when the bidder double-clicks on the item "JavaScript 3" from categories "Computers-Computer Books".

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