VISUAL INTERFACE FOR RETRIEVAL OF ELECTRONIC-FORMED BOOKS

Toyohide Watanabe
Yuichi Kanai
Noboru Sugie

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Visual Interface for Retrieval of Electronic-formed Books

Toyohide WATANABE, Yuichi KANAI and Noboru SUGIE

Department of Information Engineering,
School of Engineering, Nagoya University
Furo-cho, Chikusa-ku, Nagoya 464-01, JAPAN

Abstract:

In this paper, we address visual interface and virtual manipulation for the full text management. Our objective is to investigate the retrieval/reference mechanism of computer-readable full texts as if we manipulated paper-form books directly in the real world. This mechanism is derived basically from the object-linking facility of hyper-systems. Of course, our facility must be applicable to the manipulation of a great deal of electronic-formed books, like the traditional information retrieval systems, though hyper-systems are suitable to only private filing applications.

1. INTRODUCTION

The current issue about the management of full text data focuses on the retrieval efficiency and retrieval interface[1-3]. These subjects may be similar to those imposed on the multi-media databases[4]. The full text databases must support the navigation facility among text fragments, while the multi-media databases must supply the management facility of interrelations among different media data. Hyper-systems such as the Hypercard system, Hypertext system, Hypermedia system and so on gave some ideas to the basic mechanism for the construction of these databases[5]. Comparing with the traditional command-oriented user interfaces, the facilities in these hyper-systems got rid of syntax-specific and troublesome operations. However, these facilities are not always adaptable to the construction/management of full text databases or multi-media databases directly. This is because hyper-systems are not always applicable to manage a great deal of full text books at once, though they are successful even to manipulate a single and private document.

In this paper, we address mainly visual interface and virtual manipulation for retrieval/reference of full text databases as electronic-formed books[6]. In particular, we focus on an interactive window interface. Our basic approach is to integrate characteristics of hyper-systems into the traditional information retrieval facility.

2. FRAMEWORK

Logical and physical features are dependent respectively on the contents and forms, which compose paper-form books. Books are physical objects in themselves when we look upon them as collections of many sheets. Individual sheets can be distinguished by the unique page number. On the other hand, books can also be regarded as logical objects when we refer to individual book components such as the content data, index data, cataloging data, article data and so on. Namely, a book is a collection of these distinct item data. The concepts of pages and items take complementary roles in our retrieval/reference actions of books. Therefore, it is important to design an interactive interface based on these concepts with a view to managing electronic-formed books.

We show the logical and physical features for managing electronic-formed books in Fig.1, conceptually. The logical feature represents the logical relationships among book items, and the traditional researches about full text manipulation have focused on the retrieval/reference methods based on this logical feature because it is very suitable to computer-assisted management facilities. However, the identification of text fragments through pages is often usable for us in practice.

It is important to construct a full-text-oriented information system on the basis of physical and logical features, attended inherently to paper-form books. In managing our electronic-formed books the design principles are as follows:

1) visual interface for operations
   This may be smartly resolved as the interactive user interface in hyper-systems. Our radical subject, that is distinguished from the functionality of hyper-systems, is to establish the connective links among different text fragments automatically because a great deal of data must be constructed or manipulated at once;
2) virtual manipulation of electronic-formed books
   This will be supported on the basis of the physical and logical features. The traditional approaches provide only one of them selectively. The electronic filing

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systems, which store full text data as image files may be categorized as one of physical-feature-oriented approaches. Many current full text management systems are based on the logical feature of electronic-formed data;

3) cooperative functions for retrieval/reference of various text fragments

This will be satisfied under the integration of the visual interface and virtual book manipulation.

3. RETRIEVAL/REFERENCE FACILITY

In managing electronic-formed books, the manipulation facility should be different from those in the traditional information retrieval systems. Namely, the navigation function, which can refer to appropriately related data successively, must be necessarily supplied in addition to the ordinary retrieval function. In our framework, the access functions are divided into two steps: the first is retrieval functions to select requisite entities(or the fragments) effectively; and the second is reference functions to navigate appropriate parts of entities flexibly. It is desirable that these two functions should beusable complementarily through each interaction window.

Our prototype system for managing electronic-formed books was implemented on the UNIX-OS environment under the X-window system, the database management system INGRES and the programming language C. All user interactions are performed on visual interface windows through menu-oriented/icon-specific pointing operations. Individual data related to electronic-formed books are stored into either relational tables in INGRES as character-string data or ordinary files as image data, corresponding to the properties.

Fig.2 shows the relational tables for representing individual data fragments of electronic-formed books. These relational tables, defined in INGRES, are utilized selectively by each process. The table CT (cataloging data) accumulates mainly the characteristic information to be managed in the conventional library information systems. The other tables include statements of raw text data line by line, so that their tuples correspond to individual lines in paper-form books. Fig.3 shows the transitive relationships among different interaction windows. In Fig.3, the operational command names are attached to individual transition arrows. Practically, these transitive actions are not supplied by commands, but indicated through the corresponding functional icons.

4. WINDOW OPERATION

We explain our visual interface for manipulating electronic-formed books in Fig.3.

(1) retrieval by cataloging data

Fig.4 shows such an initial interaction window. In this case, the menu-driven method is adaptable so as to make the input action easy, and only the retrieval item FIELD is explicitly specified. Fig.5 shows a display window for retrieved results. In Fig.5, five candidates are picked up by the retrieval condition term "Artificial intelligence" after having clicked up the iconic button "Results" in Fig.4. If users retry to retrieve by other conditions, they must click the button "Retrieval" in Fig.4. When users pick up one of the buttons "choice" in Fig.5, assigned to individual candidates one by one, more detailed information is displayed visually, as shown in Fig.6. The upper buttons "Preface", "Contents", "Texts" and "Index" in this wondow are functional

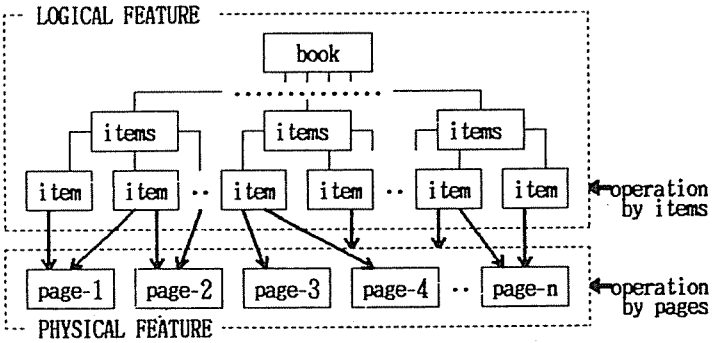

Fig.1 Logical and physical features

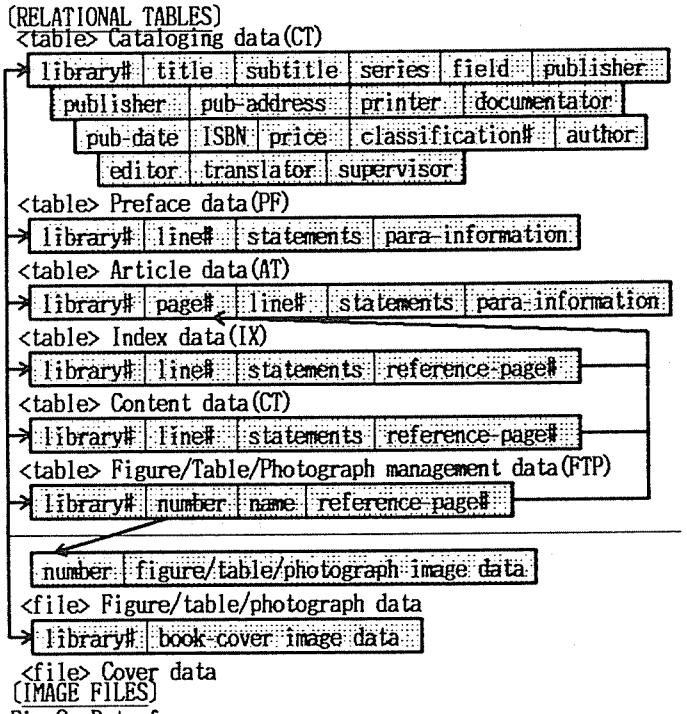

Fig.2 Data forms

icons for the next user actions.

(2) reference of preface data

After "Preface" in Fig.6 was indicated, full text data about the preface are displayed as illustrated in Fig.7. In this window, users can refer to all data by moving up/down the cursor bar, which is set on the right edge of the window. Namely, this window does not introduce the concept of pages.

(3) reference of content data

The reference function for content data is executable after users picked up "Contents" in Fig.6. The window for displaying the content data is shown in Fig.8. The buttons for page numbers, in which are set to the right sides of every content string, link to the starting pages of individual paragraph items of article data. The buttons "Pre-Page" and "Next-Page" allocated in the top level of this window make it possible to change pages of displayed content data timely.

(4) reference of index data

The manipulation of index data is implemented under the same mechanism as the reference of content data.

(5) reference of article data

The reference of article data is supported by means of two ways, as shown in Fig.3. One way is to use the buttons of page numbers in the reference windows of index and content data. Another way is to pass through direct page number input window. The windows of article data are shown in Fig.9. In Fig.9, we can observe that two windows are provided at once: window for text data; and window for a figure. They are separated from the text window with a view to making the construction and manipulation of data effectual. This separation mechanism can support multi-links between figures, tables, photographs, etc. and the reference pages of them. Namely, users can refer to figures, which are not included in the same page, from other pages. Our multi-links are created by linking keywords in figures(e.g. "Figure" or "Fig.") to the corresponding words in text data automatically. This automatic linking facility is very important in case of manipulating a great deal of full text data effectually. In the top level of this window, several buttons, menus and so on are allocated so that users can indicate the next reference actions. The button "+Page" moves the reference pointer forwards, and "-Page" does it backwards. The column "+-Page", attended to these buttons, indicates the incremental/decremental value for page navigation at once. While, the button "Page(Direct)" moves the reference pointer to appropriately indicated page directly. Also, the column "Page(Direct)" keeps the directly referred page number.

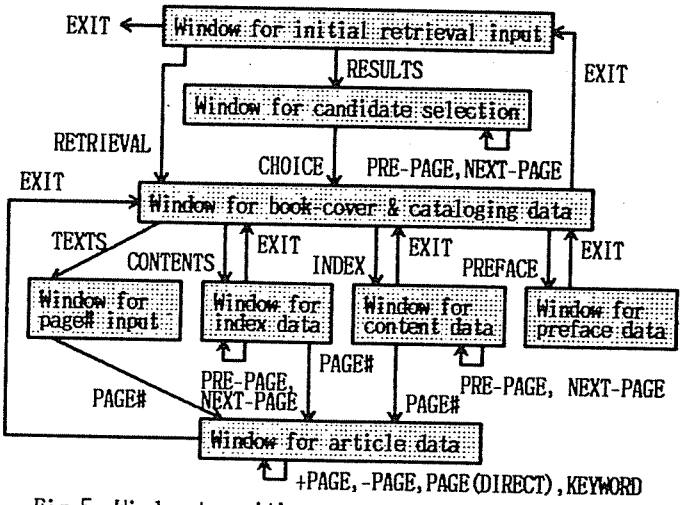

Fig.5 Window transition

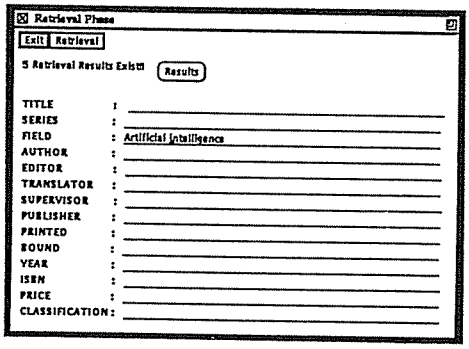

Fig.4 Window for initial retrieval input

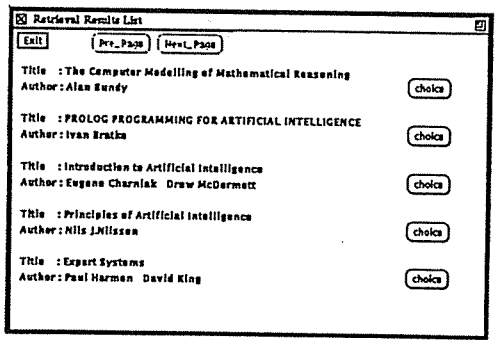

Fig.5 Window for candidate selection

5. CONCLUDING REMARKS

We addressed an information retrieval interface for electronic-formed books in this paper. Our objective is to construct electronic-formed books, as they are, on the basis of the visual interface and virtual manipulation. In our prototyping system, all facilities in the electronic libraries are not sufficiently implemented yet. However, it is clear that our visual interface is effective for end-users because the interaction mechanism is

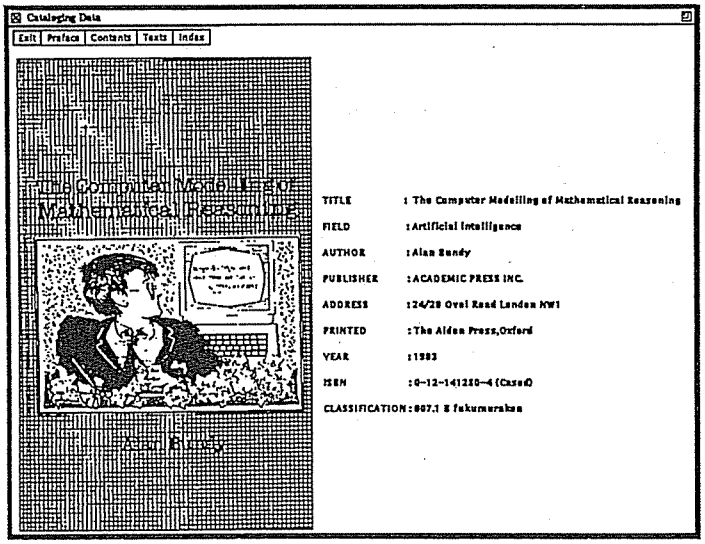

Fig.6 Window for book-cover and cataloging data

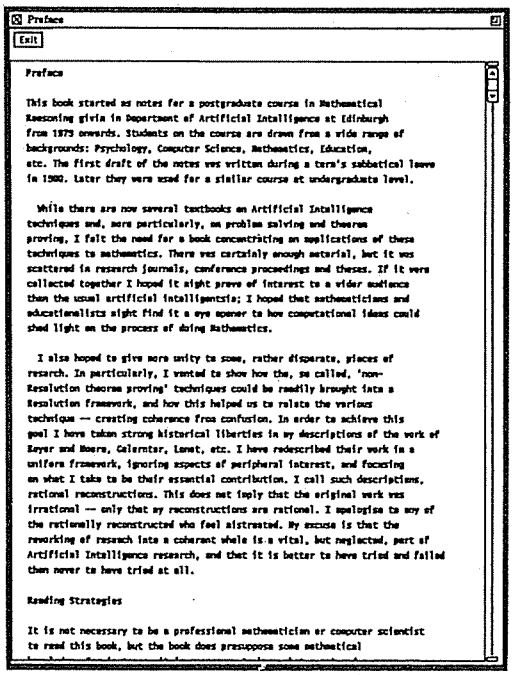

Fig.7 Window for preface data

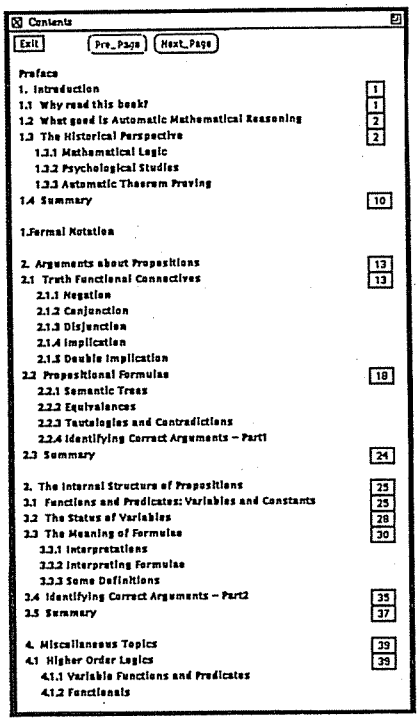

Fig.8 Window for content data

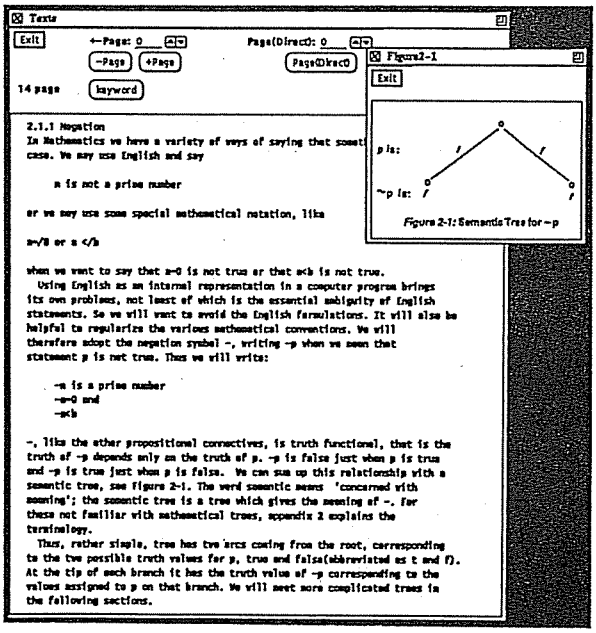

Fig.9 Window for article data

similar to our book manipulation in practical.

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