

Personal Interface Mechanism on Digital Library

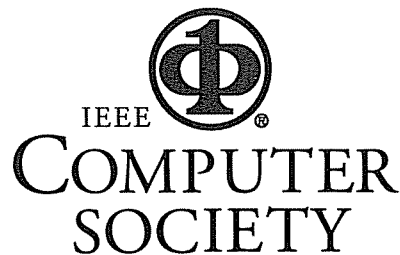
Toyohide Watanabe, N. T. Champa Jayawardana
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Personal Interface Mechanism on Digital Library

Toyohide Watanabe, N.T.Champa Jayawardana and Taketoshi Ushiyama

Department of Information Engineering,
Graduate School of Engineering, Nagoya University
Furo-cho, Chikusa-ku, Nagoya 464-01, Japan
Phone: +81-52-789-4409, Fax: +81-52-789-3808
E-mail: watanabe@nuie.nagoya-u.ac.jp

Abstract

Digital library is very useful to retrieve and refer to appropriate information directly in on-line, and many projects have been expanded progressively until today. However, the digital library with operational interface or personal/private manipulation facility is not always sufficiently investigated with a view to constructing environment in which users can apply the retrieved/referred information to their ordinary works directly or their original requests effectively. This paper addresses the subject about such personal working environment directly. So, in this paper the personal interface for digital library is proposed with respect to a working environment with personal data library, constructed on the existing digital libraries. Our main idea is to introduce the concept of notebook as user-specific data storage.

1 Introduction

Today, the on-line information reference/browsing functions are very useful and effective through WWW (World-Wide-Web). Many persons have experiments that they often retrieved/referred to some data on distributed computing resources. Digital library is one of resources for such on-line information reference, and makes it possible to access to requisite information easily/instantly from electronic-form materials such as books, pictures, newspapers, videos, films, journals, etc, without any troublesome actions/operations. Many projects about this digital library have been promoted eagerly over the world [1, 2, 3, 4].

However, the functionality is not always successful in point of personal reference because in many

cases the operational interface depends on the ready-made tools such as Netscape [4] or self-produced retrieval/reference facilities [5]. Namely, it is necessary to develop personal working environment for digital library, as if we read paper-form books and compose/edit our own documents/reports under interrelated operations between retrieval and reference [6, 7]. In our work of reference/composition environment, the functionality which copies/pastes appropriate book/material segments and then arranges our own documents/notebooks effectively can support our creative working process. Of course, the currently developed systems can support partly the functionality under the integration with the ordinary facilities.

In this paper, we address a personal interface mechanism on the digital library [8]. Especially, we focus on the reference/composition environment in which users can retrieve/refer to requisite data on the public digital library or personal data library effectively and then edit/compose personal notebooks from these retrieved/referred data. Thus, our subject on the personal interface for digital library is to construct user-specific working environment on the existing digital library system virtually: the main idea is that user has his/her own data library personally.

2 Framework

The objective about our personal interface on digital library is to construct personal reference or compo-

sition environments for individual users, where users can retrieve some interesting data from the public digital library, copy the retrieved data on their own working space according to their activities, make up the documents by using their own layouts and refer to all electronic-form documents uniformly even if the documents were public digital library and privately gathered/created data. So, the important components are the notebook, and also the associated functions. Of course, the notebook is a virtual data file to be accompanied personally with individual users, and is managed as a member of personal data library.

We illustrate our personal interface in Figure 1 conceptually. Our personal interface is not simply an operational window system, but contains its own data library (user by user). The basic component is a notebook. The notebook is a collection of individual data segments, organized systematically from the existing data library and newly created/composed data. Through this personal interface the data library and digital library are effectively referred by means of indirect retrieval and direct processing functions.

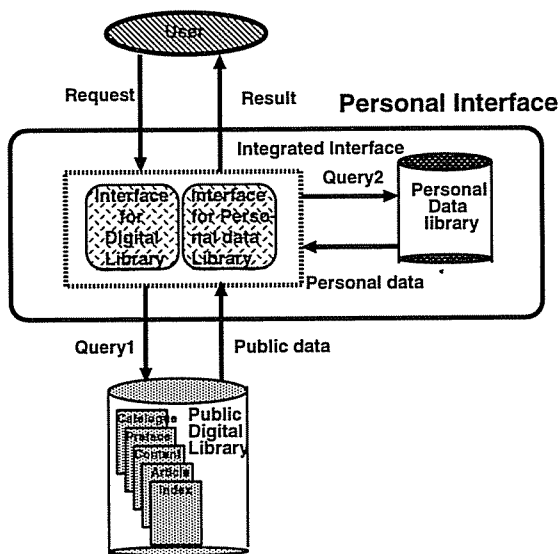


Figure 1: System structure of personal interface

3 Data Structure

The digital library may be constructed on the ordinary relational database system [5], while the data library must be developed newly, so that individual notebooks are necessarily accessible and also the contents of notebooks are sufficiently referable. The notebook is implemented under the hyperlink mechanism: individual components are linked to other components in its own notebook and/or another notebook, and/or data items in digital library [9, 10, 11].

The basic components in the notebook are "Book", "Segment", "BookSegment", "NoteSegment", "HeadingSegment", "CommentSegment", "NoteBook" and "Term", and are defined as classes.

- Book: This specifies the whole feature of notebook. The instance corresponds to a notebook.
- Segment: This represents a part of notebook when the notebook is constructively composed of different kinds of components: this specifies a sub-class as classes "BookSegment", "NoteSegment", "HeadingSegment" and "CommentSegment". The instance belongs to one of these four sub-classes.
- BookSegment: This represents appropriate part of digital library as text-type data(e.g.sentences).
- NoteSegment: This points out appropriate part of notebook as text-type data(e.g.sentences).
- HeadingSegment: This represents a user-written part instead of NoteSegment.
- CommentSegment: This also represents a user-written part as comments.
- NoteBook: This specifies the personal notebook which consists of a sequence of segments.
- Term: This represents a specific term in a personal notebook.

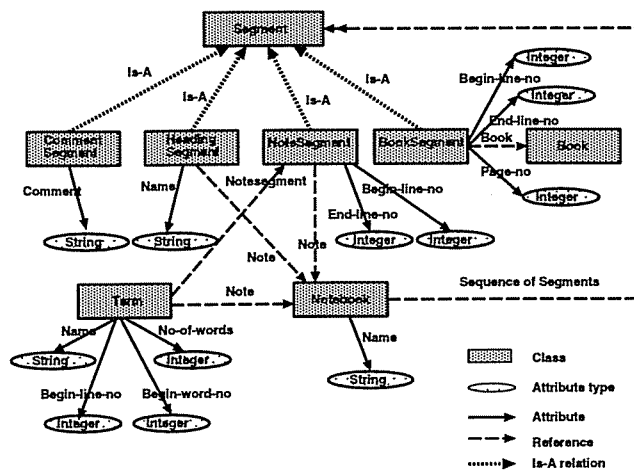


Figure 2: Data structure for library books and personal notebooks

Figure 2 shows the relationship among these classes. In Figure 2, individual classes are related mutually to other classes through some links and also are attended with particular attribute types. Figure 3 denotes instances of classes, attribute values and their relationships. An instance of Notebook "Note1" has a sequence of segments such as BookSegment "Bookseg1", NoteSegment "Noteseg1", HeadingSegment "Headingseg1" and CommentSegment "Commentsseg1". "Note1" is named as "Database System". "Bookseg1" is an instance of Book "Book1" in the form whose line numbers are from 1 to 2 in the 20th page. "Noteseg1" is an instance of Notebook "Note2", which is named as "Relational Database Languages" in the manner that the line numbers are from 7 to 10. "Headingseg1" is inserted by user, as "DbMgt". "Headingseg1" is used to refer to the instance of Notebook "Note3", denoted as "Database Management".

4 Function of Personal Interface

In our personal interface the main data components are public digital library on the existing database and personal data library, as a collection of notebooks.

4.1 Overview

The main functions to be provided with respect to the manipulation of notebooks are as follows:

1. Retrieval/Browsing for public digital library

This retrieves and browses some data stored in digital library. First, this function enforces user to give his/her request, and then makes up the corresponding query for digital library to retrieve the relevant public data. After then, the system makes the result according to the request, using public data and displays the result to user.

2. Retrieval/Browsing for personal data library

This retrieves and browses the data stored in personal data library. First, the user gives his/her request to the system and then the system makes

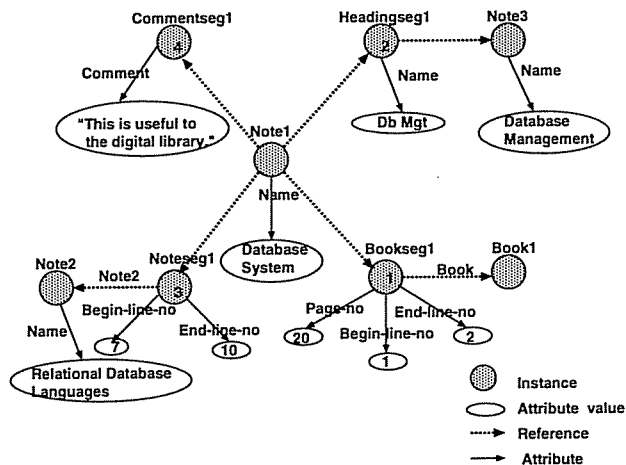


Figure 3: Class instances for basic elements of notebook

up the corresponding query to retrieve the reference data in personal data library. After then, the related query is also made up to retrieve relevant public data from public digital library. Finally, the system returns relevant result to user.

3. Load/Restore for public digital library and personal data library

This function transfers requisite data from public digital library to personal data library. After retrieving/browsing the data from digital library, user can get a library book as a result.

4. Reorganization for personal data library

By using this function, user can arrange personal notebooks according to his/her own needs. This function is useful to create personal notebooks.

In our personal interface for digital library, it is important to manipulate user-specific notebooks, in addition to usual retrieval/browsing facilities. This personal notebook is constructed by copying/categorizing requisite parts from digital library and by reorganizing the existing personal notebooks. Figure 4 shows the overview for constructing the personal notebook. The upper layer represents the digital library and the lower layer does the personal data library. A Book-Segment is a part of a library book selected according to his/her interest.

This copy is usually known as the shallow copy: when user copies a segment from a library book to a personal notebook, only the reference data are stored into personal data library. The reference data indicates the identifier of book, page number, Begin-line number and End-line number. If user wants to copy actual data to personal data library, he/she can use the deep copy. After copying instances of Book-Segment to personal data library, user can allocate them into relevant personal notebooks. This process is called "categorization".

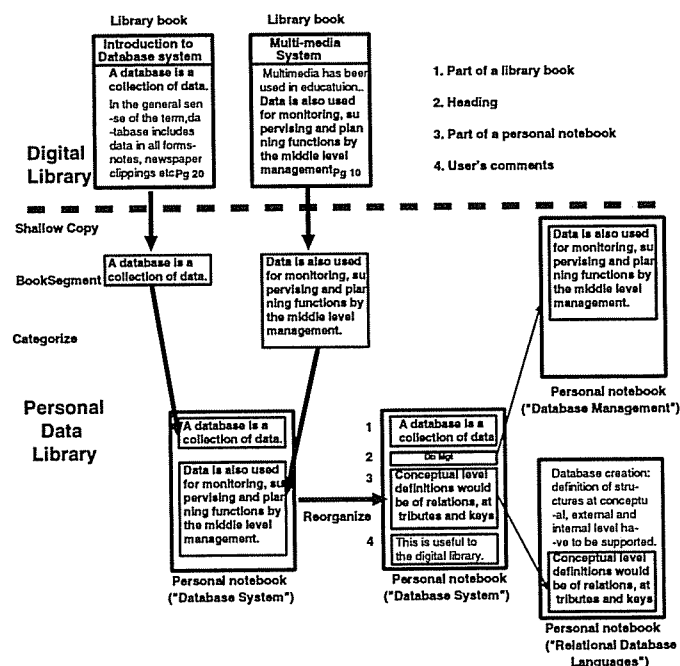


Figure 4: Overview of construction of personal notebook

In the real world, user makes up paper-form personal notebooks and arranges them so as to be able to refer to them easily. In this case, user may compose new personal notebooks for some sub-topics from the existing personal notebooks. This operation is called "summarizing". Once a sub-topic is converted into a new personal notebook, it can be utilized or referred to by other personal notebooks. Similarly, user can compose personal notebooks under new topics by collecting the existing personal notebooks. When referring to those personal notebooks, it is easy to refer to other related personal notebooks, too.

It is important to have a personal term dictionary within the personal data library. For this purpose, user can create a single term dictionary as a special personal notebook. "term description" maintains the consistency of information within personal data library. Furthermore, user can write some comments on the personal notebooks, copy a certain part

of personal notebook to the same personal notebook or another personal notebook and so on. These operations such as summarizing, collecting, term-describing, commenting, deleting, copying and so on are useful to manipulate the data in the personal notebook, corresponding to human activity. All these operations are collectively called “reorganization function”.

4.2 Reorganization Function

The reorganization function consists of some sub-functions such as editing, summarizing, collecting and term describing.

Editing function

Editing functions are deleting, copying, moving and writing, and are primitive.

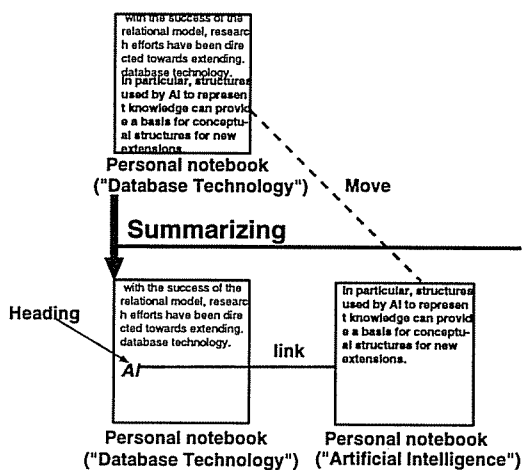


Figure 5: Schematic diagram of summarizing function

Summarizing function

This function replaces parts of personal notebooks by headings. Figure 5 depicts this function schematically. User selects a part of personal notebook “Database Technology”, which user wants to summarize and create a new personal notebook “Artificial Intelligence”, and then moves the selected part to the new personal notebook. Additionally, user introduces a new

heading-name “AI” to represent the part and write it on the personal notebook. Next, a link is created between the heading and the new personal notebook. Figure 6 shows instances with the operations for summarizing function. Figure 6 corresponds to Figure 5 from a viewpoint of data structure. The sequence of operations is “1 → 2 → 3 → 4 → 5 → 6 → 7”. First, it is necessary to specify an instance of Notebook “Note1” and create an instance of NoteSegment “Noteseg1”. After creating a new instance of Notebook “Note2”, “Noteseg1” is inserted into it. Then, “Noteseg1” on “Note1” is deleted. After then, an instance of HeadingSegment “Headingseg1” is created on “Note1”. Finally, “Headingseg1” is linked to “Note2”.

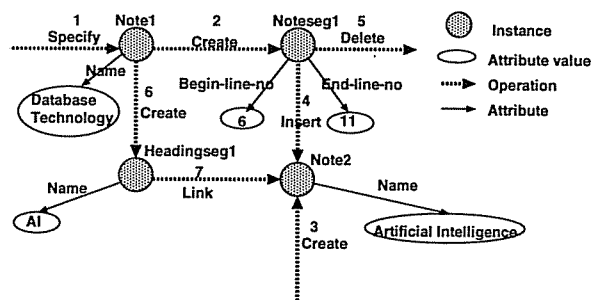


Figure 6: Class instances with operations for summarizing function

Collecting function

This function collects the existing personal notebooks into a new notebook. In Figure 7, user selects personal notebooks “Relational Data Model” and “Network Model”. Then, user creates a new personal notebook “Data model” and introduces headings “Relational” and “Network” to represent the selected personal notebooks on the new personal notebook. The links are created between the headings and the personal notebooks. The instances with the operations for collecting function are depicted in Figure 8. Fig-

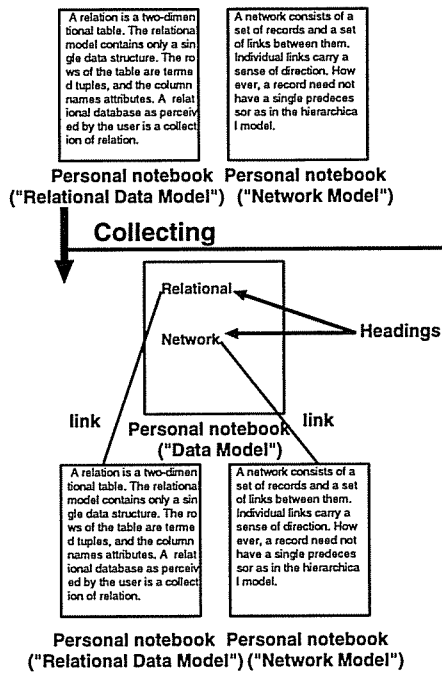


Figure 7: Schematic diagram of collecting function

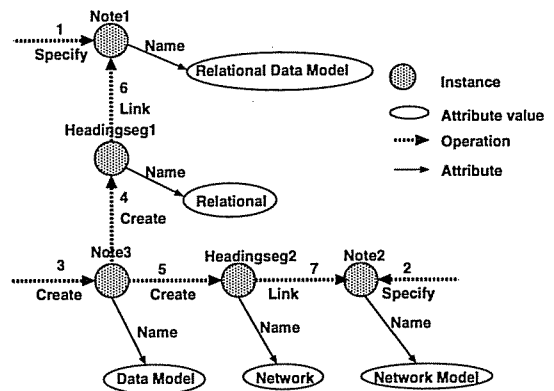


Figure 8: Class instances with operations for collecting function

Figure 8 corresponds to Figure 7. The sequence of operations is "1 → 2 → 3 → 4 → 5 → 6 → 7". First, instances of Notebooks "Note1" and "Note2" are specified. Then, a new instance of Notebook "Note3" is created. After then, instances of HeadingSegments "Headingseg1" and "Headingseg2" are created on the new instances of Notebook "Note3". Finally, instances of HeadingSegment are linked to instances of Notebooks "Headingseg1"- "Note1" and "Headingseg2"- "Note2".

Term describing function

This function connects terms to their descriptions. There is a special personal notebook "term-dictionary" which has the descriptions of technical terms. In Figure 9, user selects the personal notebook "Database Technology" and specifies the term "AI". Then, he/she finds the relevant description for requisite term from the special personal notebook. After then, the link is created between the term and the

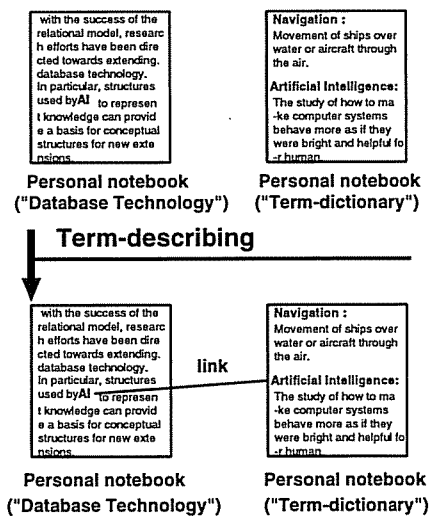


Figure 9: Schematic diagram of term describing function

relevant description part. Figure 10 shows instances with the operations. The sequence of operations is “1 → 2 → 3 → 4 → 5”. First, it is necessary to specify an instance of Notebook “Note1” and an instance of Term “Term1” on “Note1”. Then, the instance of Notebook “Note1”, which is named as the term dictionary, is specified. After then, it is necessary to create a relevant instance of NoteSegment “Noteseg1” for “Term1” from “Note2”. Finally, “Term1” is linked to “Noteseg1”.

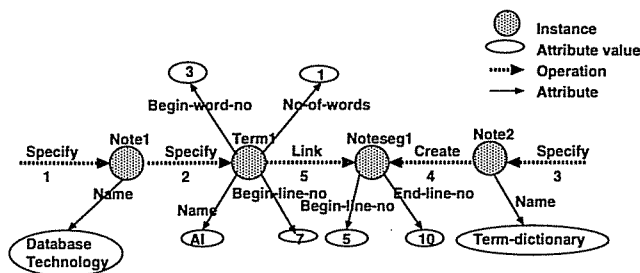


Figure 10: Class instances with operation for term-describing function

5 Implementation

Our prototyping system was implemented on WWW server. We used Mini-SQL as database management system to develop digital library and personal data library, and also META-HTML as programming language to implement the interface between user and digital library. Mini-SQL is a lightweight database engine designed for the fast access to stored data with low memory requirements. META-HTML is an interpreter-specific computer language with dynamic variables and flow-control statements.

We look upon the library books as logical objects and the components of individual library book are content data, preface data, cataloging data, article data, index data and so on. The tables for content data, preface data, cataloging data, article data and index data were prepared separately. The contents of library books were stored line-wisely on these tables.

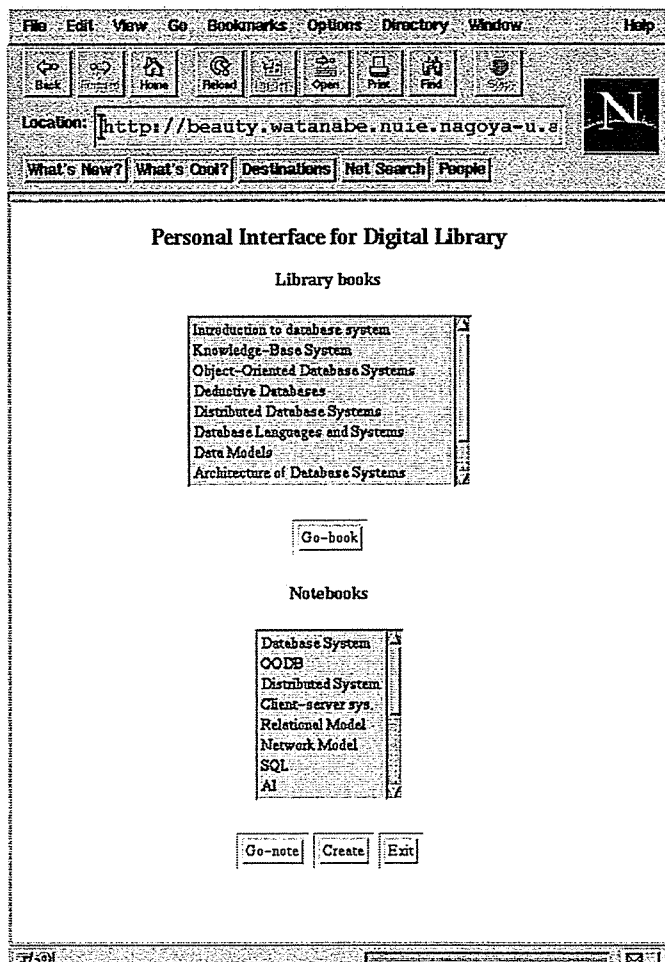


Figure 11: Starting window

Starting window

Figure 11 represents the starting window for personal interface. In this window, there are two scrolling lists. One shows the list of library books in digital library and another shows the list of personal notebooks in personal data library. In addition to two lists, there are also some buttons such as Go-book, Go-note, Create and Exit. To open the required library book, first it is necessary to select the name in the scrolling list by clicking the mouse button and then press Go-book button. Similarly, to open the required personal notebook, user can click the mouse button to highlight the name of personal notebook in the scrolling list and press Go-note button. When user creates a new personal notebook, he/she can use Create button.

Window for library book

Figure 12 shows the window for a library book. In this example, the content of library book "Knowledge-base System" is displayed. There are facilities to move forward or backward, page by page, using Next-page and Pre-page buttons, respectively. There is also a facility to jump to the required page by indicating the page number. Additionally, there is the facility to copy required parts of library books to personal notebooks. If user copies the required part of library book to the existing personal notebook from the menu list, he/she can press Select button. If user copies the required part to a new personal notebook, he/she can create a new personal notebook, by using Create button. Finally, user can press Copy button for copy operation. Exit button can be used to exit this window.

Window for personal notebook

Figure 13 shows the window for a personal notebook. In this example, the content of personal notebook "Database System" is displayed. To carry out the operation for reorganization function, several buttons and a pull-down menu are set in this window. The

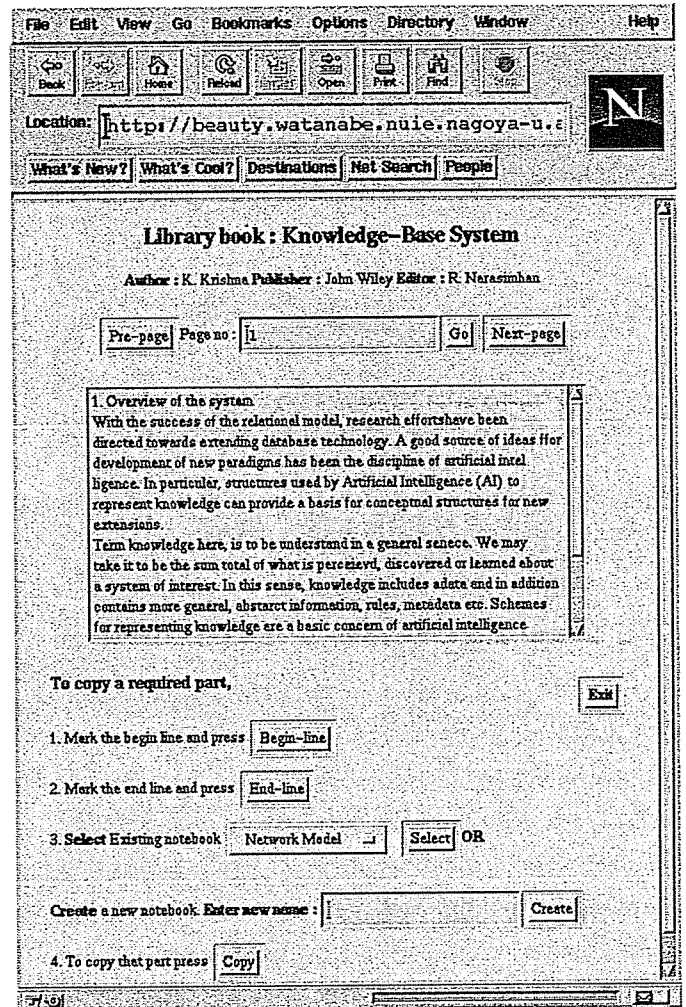


Figure 12: Window for library book

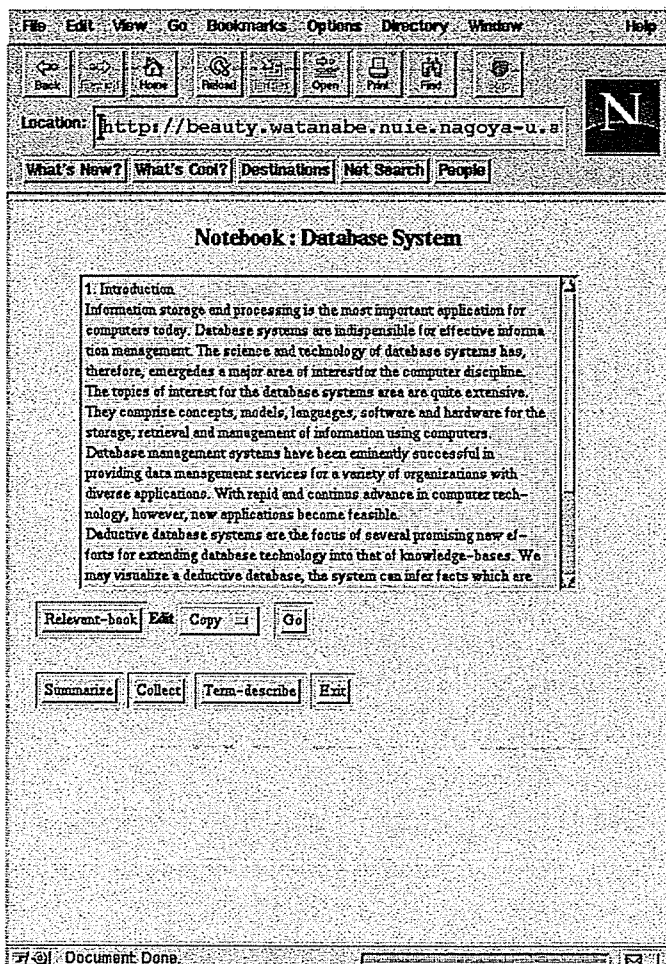


Figure 13: Window for personal notebook

buttons are named as Summarize, Collect and Term-description to simply indicate their functions. The pull-down menu carries out the editing functions such as Copy, Delete, Move and Write. If user selects Delete operation from Edit pull-down menu, another new window will appear. In this window, he/she can mark a segment to delete by selecting Begin-line and End-line of segment. To insert user's comments into a personal notebook, Write operation can be selected from Edit menu. Once Write operation is selected, user will be prompted to enter his/her comment and the location. A part of personal notebook can be copied or moved to the personal notebooks. Two operations Copy and Move are available in the pull-down menu. There are two methods of copying or moving, and Internal or External. User can select any method according to his/her requirement. Internal copying or moving is done only within one personal notebook. On the other hand, the external copying or moving is carried out between two personal notebooks.

To summarize a part of personal notebook, Summarize button can be used. After pressing Summarize button, another window will appear. It contains facilities to select the required part of personal notebook by selecting Bigin-line and End-line, to introduce a heading-name to represent the part, and then to introduce a new name of personal notebook. Thereafter, a new personal notebook will be created for this newly introduced name, and the specified part is moved to this new personal notebook automatically. Finally, the existing personal notebook can be seen with the introduced heading name, instead of the part. To carry out the collecting function, Collect button should be clicked. Once Collect button is pressed, user can see a new window with a list showing the available personal notebooks. Thereafter, user can select personal notebooks in his/her personal data library. For each selected personal notebook, user is prompted to enter the relevant heading that should appear in the

new personal notebook. These heading names represent the selected personal notebooks. By clicking these headings, user can see the contents of relevant personal notebook. To carry out the term describing function, Term-description button can be used. By pressing Term-description button, user can specify the required term, in addition to clicking the mouse button once on the relevant line. There is a facility to get special personal notebook "Term dictionary". From this special personal notebook, relevant description part for the required term can be selected. After then, when referring to the personal notebook, user can see relevant description part by clicking on the line with relevant term. Book button is a special button, which can be used to find out the details of relevant library book (i.e. title of library book, author, publisher, editor, page number, line number and so on) for a certain statement in a personal notebook.

6 Conclusion

In this paper, the personal interface, which enables users to make use of digital library effectively as private data library, was proposed. In particular, we addressed the framework with respect to the functionality and data structure, and also implemented the prototyping system. When we investigate the effective utilization mechanism for digital library, it is better to support successful reference environment for electronic-form books as if all the manipulations were similar to the practical operations in our real world. Our personal interface on digital library is successful for such a reference environment. Of course, our current version is very limited in point of the total applicability for information reference/access mechanism.

As one of our future works it is necessary to integrate our personal interface with digital libraries or information resources in many WWW servers or their information resources systematically in addition to the improvement of the basic/applicable functions.

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