

DESIGN OF E-BOOK VIEWER FOR PDA SUPPORTING ANNOTATION EDITING

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ABSTRACT

Because of today's rapid growth of digital contents market and many benefits of electronic book, many people have considerable interest in E-book. Furthermore multifarious consortiums take an active part in standardization of E-book, and many E-book tools have been provided by software manufactures all over the world. E-book tools include editor for production of E-Book, viewer for reading, and the like. Especially in E-book viewer, annotation function has to be included to put arrangement, summation, recording, comment, emphasis and after comprehension to practical use. In this paper, a E-book viewer with annotation is designed according to the specifications of EBKS, Korean standard. The proposed viewer is aimed to implement in PDA with embedded Linux, but developed in Windows 2000 platform. Because development environment and application environment are different each other, Qt-Library and cross-compiler are used for cross-platform development. The viewer support various functions such as adjusting of font size, hypertext linking, retrieval of specific word, and so forth. And in addition to these basic functions, annotation function is designed for the viewer, which can be used for re-usage and sharing of important information.

Key words: E-Book Viewer, Annotation, Annotation Editing, EBKS

1. INTRODUCTION

Today, with infinite development of Internet and expansion of related infrastructure, importance of digital contents has been increasingly strengthened. Especially, the e-book industry has been stand out the most attractive new industry in the field of digital contents.

Large companies such as Microsoft, Amazon, and Time Warner of U.S. make efforts to dominate e-book technologies globally, and other countries including Canada, Japan, and Singapore are keenly striving to revive the e-book industry suitable for their context. At present, the e-book industry has been greatly attractive worldwide due to combining development of computer technologies, rapid growth of digital contents market by rapid spread of Internet with benefits of e-book complexively[11].

However, with respect to e-book document format, as each company uses various types of document format, it is difficult to exchange among documents and representation measures of users' opinion or thoughts in e-book is not defined systematically. In addition, there is no studies on sharing or exchanging information added to the e-book environment. Accordingly, a consortium was constructed to standardize e-book documents in U.S. and Japan. In Korea, EBKS was constructed to exchange e-book contents correctly and EBKS 1.0 Draft based on XML was prepared in April 2001[2]. Therefore, problems about companies' unique format have been solved. And, addition of user's opinion or thoughts to e-book allows using annotation that was used in traditional books. Features of annotation is that a user can search and share keyword to the annotation. User can search the desired information rapidly by searching keyword to annotation and exchange various opinions by sharing annotation[10].

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Therefore, this study attempted to design an E-Book Viewer supporting annotation editing in PDA with Embedded Linux on the basis of EBKS, a domestic e-book standard.

2. RELATED STUDIES

2.1 Trend of EBKS

EBKS was produced with a view to exchanging e-book contents without vagueness, and it means reflection of the most urgent needs in the Korean e-book industry. On the other hand, EBKS decided XML, which can overcome difficulties of HTML in structure expansion and separation of contents and style, lack of additional information and structure information, and low reusability PDF and satisfy the above issues, as a basic format of eBook Korea Standard (EBKS) to ensure interoperability, acceptability, scalability, applicability, publicity, and simplicity.

EBKS contains a fixed document structure unlike OEB PS of U.S. and jepaX of Japan and supports structures of most books published in Korea.[2]

2.2 XML

(1) Features of XML

- XML developed by XML Working Group with the support of W3C(World Wide Web Consortium) in 1996 is a simple and flexible language based on SGML supplementing defects of HTML and allows definition of document structure and definition of powerful web documents at the SGML level.

- it is composed of XML document files and DTD file style sheet, allowing interlinkage with a core system such as DTD and XSL, structured and logical arrangement of documents, designation of various styles.

- it has universality allowing the desired search easily

(2) XML as a Data

- Universality : A use creating a XML file can

make tags related to contents directly. XML files contain only information relating to document structure and meaning and excludes parts decorating elements into style sheet.

- Due to close relationship of tags and document contents, a XML file itself can play a role of well-designed database.

- Popularity : XML accepts all benefits of SGML and HTML and can be integrated with any type of application as well as web browser; it is a universal database.

- Diversity : XML of a data file has various forms with XSL.

2.3 Present Conditions of E-Book Viewer

Businessmen required of schedule and customer management or university students have a number of personal information in everyday life. This information has been recorded and applied to diary, pocket notebook or e-notepad in ineffective manners.

PDA improves ineffective methods in management of personal information by basic option programs and additional applications. And, personal data management programs for PC is also given to PC versus those programs for PDA, supporting modification, addition, and backup of entered information by connection between PDA and PC, then proposing a new level of personal data management plan.[9]

Current e-book services and studies have very insufficient functions including addition, sharing, and exchange of reader's information on e-book contents. Therefore, it is certainly necessary to apply annotation used in the existing books for solution of these problems. Annotation means additional sentences or text with a view to noting, explaining, and strengthening subjects and contents of a document at large. In a paper-based document, annotation is used to arrange, summarize, interpret, and record document contents, and is especially expressed into underline, symbols, and

notes. Therefore, annotation data is not dispensable but important for reuse and sharing. Moreover, it is more required in the e-book environment. The reason is that annotation of e-book unlike paper-based documents can provide various functions such as link, explanation, interpretation, strengthening, and questioning of document contents as well as re-editing, reuse, search, and sharing of annotation.

However, the current e-book system supports only simple functions like creation and viewing of annotation, and other technological studies relating to annotation are very insufficient. Core technologies for application of annotation in e-book are divided into two (2) categories; cognitive annotation interface for easy use and context-based annotation recognition technology. Context means a part of an original document with added annotation, so that size, position, and structure information of this context should be facilitate to recognize and use annotation[5].

2.4 Developmental Environment

This study was to design E-Book Viewer for PDA with Embedded Linux and its developmental environment is as follows.

- OS : Windows 2000
- Library : Qt/Embedded 2.3.1
- Compiler : cross compiler toolchain

Qt Library used in this study is C++-based GUI Library and supports various platforms such as Windows, Unix, Linux, Mac, Zaurus, iPaq, Cassiopeia, and Generic PDA ensuring compatibility of source code[8].

It enables to reduce time for porting the current Windows-based source to Linux or Unix, and to create Windows- and X-Windows-based execution programs with the same source in future. And, it allows creating not interpreter-type code like Java but pure execution code.

Embedded Linux is Linux used in Embedded

System, which is generally an aggregate of H/W and S/W such as PDA (Personal Digital Assistant), GIS (Geographical Information System), medical information terminal, terminal for stock market, and remote-controlled devices for medicine and industry. Benefits of Embedded Linux include no purchasing cost and license and excellent implementation of TCP/IP stack. And, in applying micro kernel, it enables to build Embedded System with very little memory, to easily transplant between heterogeneous devices due to support of various types of CPU.

3. DESIGN OF E-BOOK VIEWER

This system consists of Data Loader, Bibliography Generator, Data Manager, Renderer, Annotation Editor, and Navigator on a large scale[7].

Fig. 1. shows the entire system configuration of the E-Book Viewer designed in this study, and composition and functions by major modules are as follows.

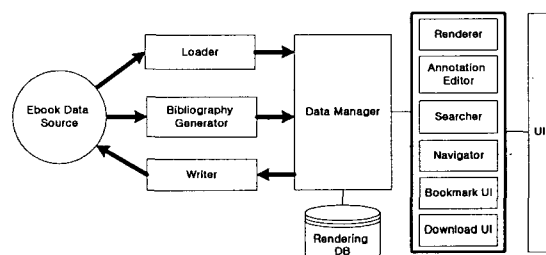


Fig. 1. Entire System Configuration.

3.1 Data Loader

E-Book Data Loader forms E-Book Data Source (annotation data, E-Book data, setup data, multimedia data) into an internal data structure of a form required by each module, and transfers it to Data Manager. All data types used in this system applied XML, while a XML parser in this study was MSXML parser supplied by Microsoft. Fig. 2. shows Data Loader Configuration.

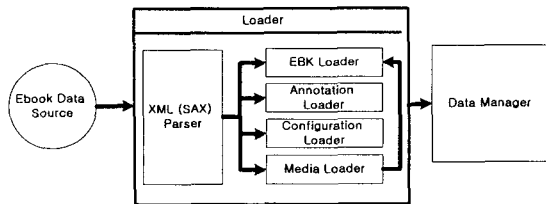


Fig. 2. E-Book Data Loader Configuration.

3.2 Data Manager

Fig. 3. shows Data Manager configuration. This Data Manager plays a role of managing internal data created by the Data Loader and managing the internally created data. Also, this module performs conversion of the internally created data (annotation data, setup data, etc.) into XML format to save outside.

The Data Manager is a collection of various data managers and is divided by relevant data format as follows: first, Rendering Tree Manager managing data processed into data type for rendering; second, Annotation Manager managing annotation data created by customized edition in a list type; and finally, Configuration Manager managing data for settings of E-Book Viewer. These individual data managers provide interfaces to ensure that it supplies data for each related module.

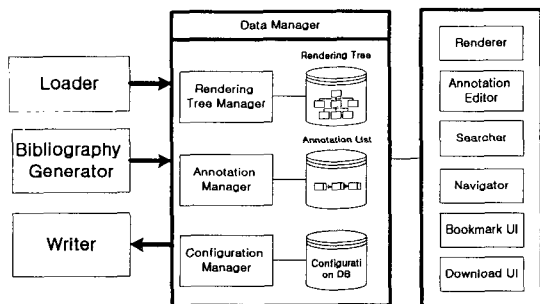


Fig. 3. Data Manager Configuration.

3.3 Bibliography Generator

E-Book contains bibliography information in E-Book Data or additional types of bibliography information. EBKS suggests that E-Book Data shall contain bibliography information, so we imple-

mented Bibliography Generator to extract this bibliography information. Fig. 4. illustrates Bibliography Generator configuration.

Some bibliography information included in E-Book can contain its own information or image about cover image. In this system, if any image is included, we made load the image with Cover Image Loader. Created bibliography information is managed as rendering data by Data Manager.

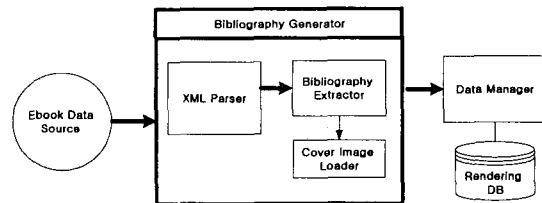


Fig. 4. Bibliography Generator Configuration.

3.4 Renderer

In this system, we defined screen display format only for an element relating to screen layout, and did not support style sheet. Renderer gains objects as a target of rendering by Data Manager, and displays them in screen. In this case, we made help paging, calculating the rendering-targeted objects by a single page. And, Renderer detects and interprets user's behaviors (mouse, stylus, keyboard, etc), sends a message to the relevant module, and supports suitable processing in the relevant module.

Basic unit of rendering is an element, whose processing method is decided internally, then rendering is attempted. For instance, <title> of an element defined in EBKS was designated in "Font Size=15, colo=Green", and was to be rendering in screen. Fig. 5. describes Renderer configuration.

4. ANNOTATION EDITING

Annotation is defined as 'explains meaning of a word or sentence easily in a dictionary. Annotation in this system means making a user's mark (image, memo, underline, etc) in E-Book as needed. The reason why we made support this annotation

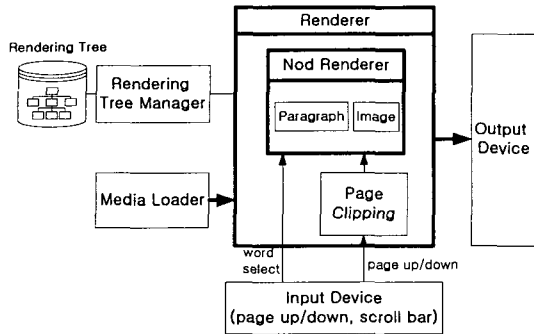


Fig. 5. Renderer Configuration.

editing is that we ensure that user's behavior in the existing books can be supported in also E-Book. Types of annotation suggested in this study are as follows:

- Drawing
- Note
- Bookmark
- Highlight

Annotation Editor is a module supporting various types of annotation editing mentioned in the above.

Data created by user's annotation editing is saved and managed into XML extra for E-Book. Fig. 6. shows mutual processing of Annotation Editor and Data Manager.

Drawing among types of annotation possible for editing supports a user to draw a picture in screen. If a user wants drawing, Annotation Editor requests information on the relevant page of E-Book that the user asks drawing edition to Renderer. Annotation Editor receiving information about the page provides a drawing editing interface to the user, transmits the entered data to Data Manager, then saves editing information.

Editing other annotation is processed through an internally similar process. First, a coordinate where annotation is positioned by Renderer is gained. This coordinate can be either relative coordinate or absolute coordinate; however, the absolute coordinate is used in this system. An Absolute coordinate of object means a coordinate on the basis of the first object in the first page - the

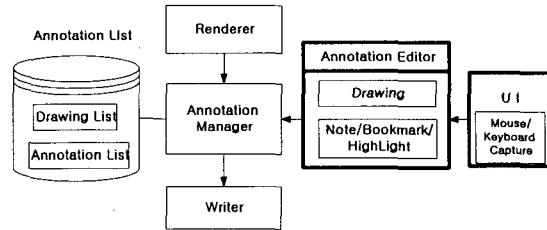


Fig. 6. Annotation Editor Configuration.

targeted first object.

Note among annotations supports a user to write in the specific part with keyboard. Bookmark literally supports bookmark function, while High-light means marking function the specific part with various colors. Highlight supports only visual ex-pression.

```

...
<element name="URI" type="uriReference"/>
...
<element name="Annotation">
  <annotationType>
    <sequence>
      ...
      <annotationType>
        <sequence>
          <element col=blue minOccurs="1"
            maxOccurs="1"/> //Definition of annotation
        </sequence>
      </annotationType>
    </sequence>
    <attribute name="valid"
      type="valid"/> //Definition of annotation type
  </annotationType>
</element>
...

```

Fig. 7. XML Schema for Annotation.

Fig. 7. illustrates XML Schema to support these annotation functions. Annotation functions including Drawing, Note, Bookmark, and Highlight are saved as shown in Fig. 7. The saved annotation functions are saved again in a single object as shown in Fig. 8.

In the above Fig. 7, <annotationType> defines annotation type i.e., which type of annotation was used among Drawing, Note, Bookmark, and High-light. <element> part describes various detailed attributes used in annotation such as position of annotation (coordinate), annotation color.

<attribute> illustrates which annotation in the document was used among Drawing, Note, Book-mark, and Highlight, and gives a title of the used annotation. <annotationType> can include multiple <annotationType> provided that the type of annotation should be identical.

```

<?xml version="1.0"?>
<mergedAnnotation ... annotype="type1">
  <ma xlink:type="extended" id="01">
    <uri xlink:type="..."
      xlink:label "uri"/>
    <Ppa user="user2"
      xlink:type="..."
      xlink:label="annotation"/>
    ...
  <writeNotesOn xlink:type="arc"
    xlink:from="annotation"
    xlink:to="uri"/>
  ...

```

Fig. 8. Integrated Annotation.

In the above Fig. 8. shows integration of annotation functions defined in Fig. 7. into each annotation type. <mergedAnnotation> illustrates the annotation type to be integrated, while <ma> expresses the annotation to be integrated. <uri> describes the relevant page positioned of annotation, <Ppa> addresses features of the annotation. <writeNotesOn> shows relationship among various annotations used in the page.

5. CONCLUSION

This study was attempted to design E-Book Viewer for PDA supporting annotation on the basis of EBKS as an E-Book standard with QT Library in the Windows environment and to allow creating and sharing wider and more enormous amount of documents. Especially, e-book based on XML of a standard document format in EBKS enables users to search the desired information from phrase to each word by using hypertext and search function.

In addition, it is expected to lead the wide subjects of study in other fields such as e-Commerce and electronic data interchange (EDI) with various applications of e-book based on XML

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