

Documentation Tool: an Object oriented Model for Electronic Library Management

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Abstract

This work is in the domain of Electronic Document Management (EDM) [1]. The documents can be an electronic writing, an image, a sound file, a network protocol message, a set of data organized in a file. The principal objective of this paper is to design and implement an electronic library [2] based on an object oriented approach [3]. This library will be used as a documentation tool by the different participants in a scientific community of teaching and training environment. In the design of this library we have to design and implement storage method that uses XML [4] format for the scientific documents.

Key Words: Electronic Library, Information Literacy, EDM, UML, Object Oriented Approach.

1. Introduction

The work presented in this article proposes an architecture model based on an object oriented approach to implement an electronic library for a better exploitation. The modeling language UML [5] is used to design the model. The modeling of the electronic library is described by the following different diagrams: the case based diagram makes it possible to structure the user's needs and the objectives corresponding to the system; the class diagram is a collection of static modeling elements (classes, packages...), which show the model structure. The sequence based diagram shows the interactions between the objects in the system and the component based diagram makes it possible to describe the application physical and static architecture in term of modules: source files, libraries, executable, etc.

This modular structure allows the hierarchical design of the scientific documents and gives more importance to the storage problem of the scientific documents in an object based environment in order to get a better exploitation.

2. Information Literacy

Information literacy is the mastery of the intellectual and operational processes that enable individuals to satisfy their information-related needs in various life situations. There are countless situations of this type: fundamental or technical knowledge acquisition, writing activities (summaries, reports, project proposals, etc.), problem solving (searching for factual information, a technical solution, etc.), and so on. Given that information-related situations are infinitely variable, so are the corresponding informational needs. Based on the related research, a typology of user needs can nevertheless be drawn up. Becoming information literate in effect amounts to mastering certain processes.

An "informational process" is a process that includes four main phases:

1. analysis (analysis of a need for information, description of that need, representation of the goal to attain);
2. information seeking (finding and collecting documents, guidance, and data) from a range of information sources (databases, catalogues, experts, etc.) by means of various tools (query interfaces, reference lists, directories, etc.);
3. information processing (reading, analyzing, and deciphering documents and accounts, assessing relevance and validity, note-taking, extracting useful information, selecting, sorting, ranking and ordering information, etc.);
4. information use (acquiring new knowledge, producing summaries, write-ups, reports, and bibliographic notes, giving talks, discussing and comparing with peers, etc.).

An electronic library management tool can be used to record, modify, delete, or print all document references. An area for writing comments about the documents or for simply taking down notes is set aside for each reference created (references are shared by members of the same group) [6].

3. Motivation and Objective

According to [7], the digital libraries are information systems in which all the information resources are available in a format that can be managed by a computer. All the acquisition, storage, conservation, search, access and visualization functions use digital techniques.

With the availability of Internet technologies [8] and because it is neither practicable nor acceptable to ask distance learners to travel to a specific site (which may take a lot of their times which they do not have, that is why they decided to be distance learners in the first place) to search for the necessary information. Also learners would like to have simultaneous access to all needed resources such as the courses, from any place, at any time, using whatever device (available to them) that is connected to the Internet. Also, we are very well aware of the electronic libraries contribution to the education and its benefit to the knowledge transfer. Then the idea to design and implement an electronic library proves to be a necessary tool that must be available not only to distance learners in particular but to all

learners in general. The integration of the recent development techniques and the distributed digital content improves the learning pedagogical experience.

We aim to design and implement an object oriented model of an electronic library. This will improve the teaching process because it facilitates the access to courses, books, theses, and also access to electronic course notes (ECN) which constitutes a must companion document to any course.

4. Object Oriented Modeling of an Electronic Library

4.1. Use Cases Diagram

In our system, we find two principal users: the administrator and the reader. Each user has his own tasks to achieve according to the kind of accesses allowed by the electronic library. The following diagram represents the use cases of the electronic library.

The data base management is summarized around the following operations: document addition, document removal and document modification are done by the administrator. The reader is allowed to perform only the following operations:

- Search for a document according to precise criteria: Search by topic, Search by author, Search by publication year, Search by keyword and Search by supervisor name (for thesis).
- Consulting the searched documents.
- Remote downloading of a document.

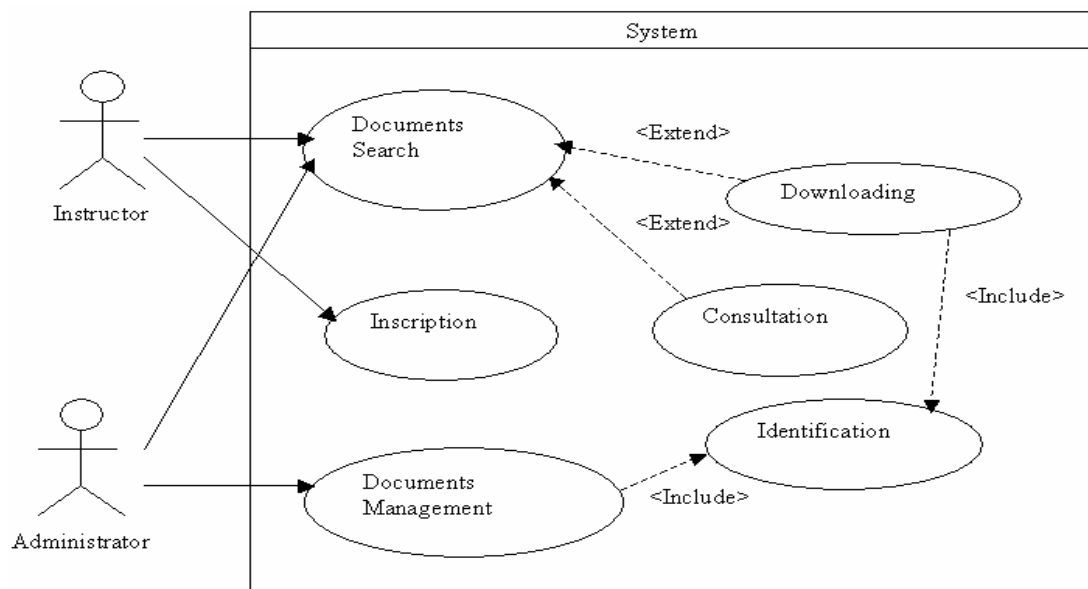


Figure 1: Use Cases Diagram

4.2. Class Diagram

The class diagram expresses in a general way the static structure of a system in term of classes and relationships between these classes.

In our case, there are three principal classes: one for the author, one for the reader and a super-class document which has subclasses which are: Book, Thesis, Paper and Course.

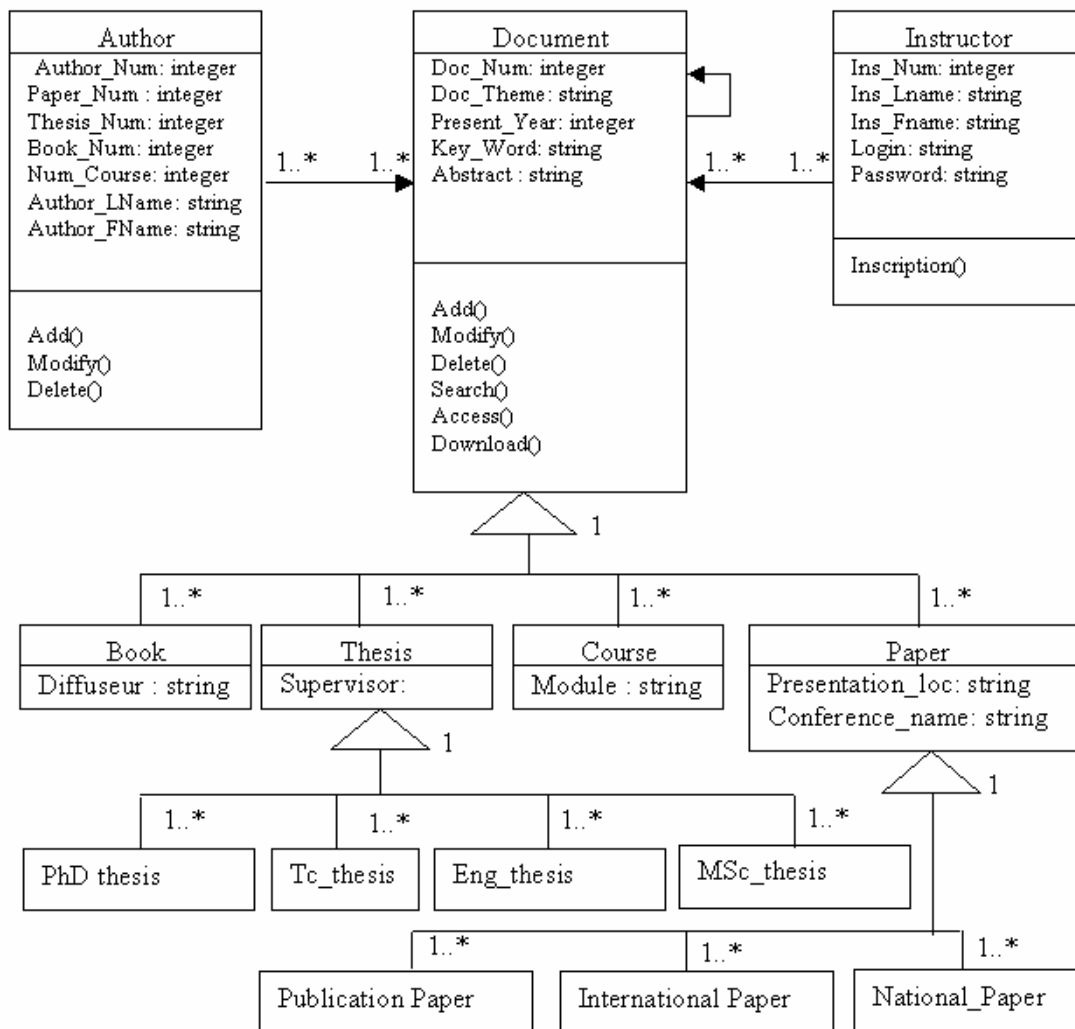


Figure 2: Class Diagram

4.3. Sequence Diagram

The sequence diagram is very important to understand the aspect dynamic of the application because it illustrates its dynamic aspect. This diagram is a graphical tool that represents the different interaction between the objects of the electronic library with respect to the time.

Figure 3 and Figure 4 are example of sequence diagram. The first one illustrates the way to search for a document; the second explains the operation of adding a document.

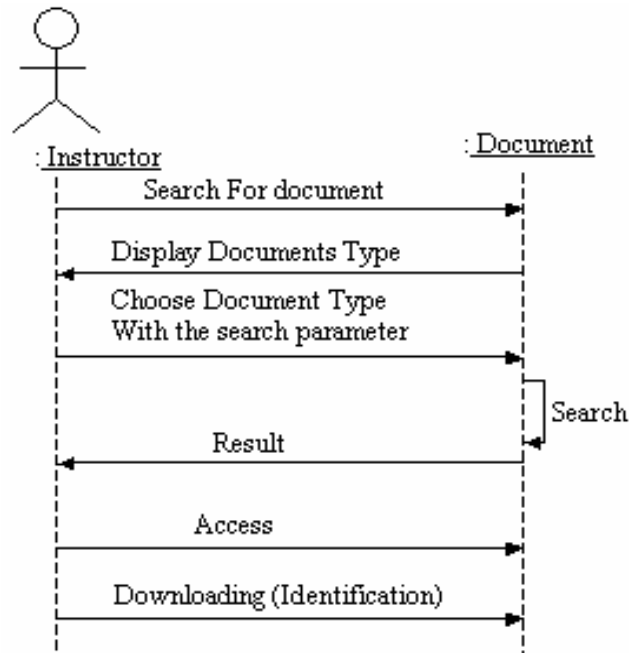


Figure 3: Document Search

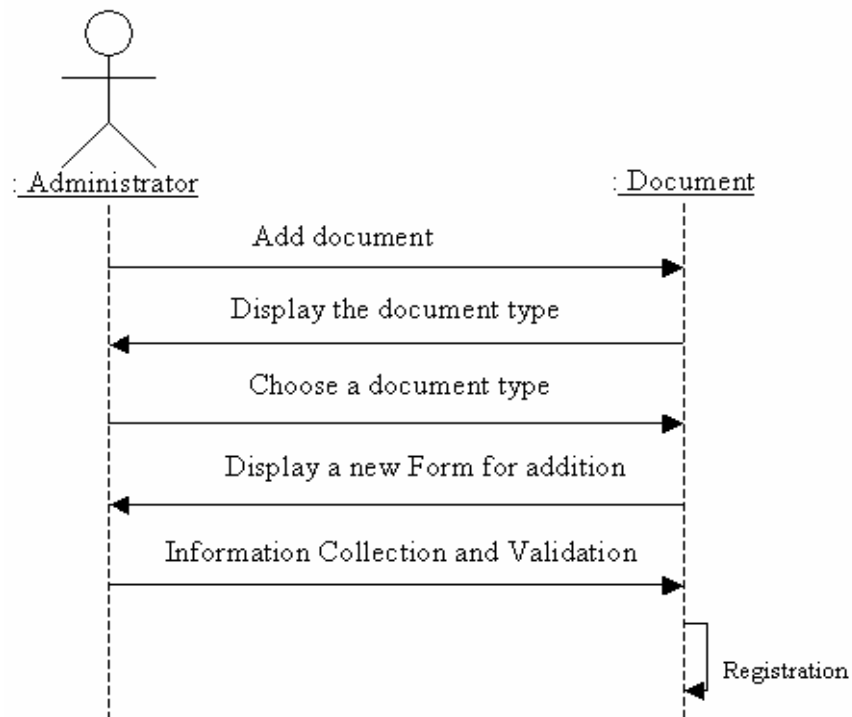


Figure 4: Add a document

5. Advantage of Object Oriented Model for Electronic Library

We chose an object oriented method to model an electronic library because the object oriented approach supports, among other, the development of:

- Applications that can be combined between themselves. For example, using standard interfaces to make software components communicate (compatibility).
- Reusable applications which can be re-used to develop new applications.
- Extensible applications that can be adapted to specification changes. For example: to minimize the modifications to be made in implementation when the specifications are modified.

6. XML Structure for Electronic Documents Storage

6.1. DTD: Document Type Definition

A DTD makes it possible to define in a formal way the reference structure of a document, administrative forms, commercial or financial transactions independently of their contents. It is a set of structuring rules which specifies what is allowed or what is not allowed in a document [9].

The following DTD is adapted to a thesis logical representation (Figure 5):

```

1  <!ELEMENT thesis (preliminaries, body, postliminaries)>
2  <!ELEMENT preliminaries (identification, (acknowledgment)*, (dedication)+,table_of_content)>
3  <!ELEMENT body (introduction, chapitres, conclusion)>
4  <!ELEMENT postliminaries (abstract, bibliography, glossary, annex)>
5  <!ELEMENT title (#PCDATA)>
...
n  <!ELEMENT website (#PCDATA)>

```

Figure 5: Example of DTD

6.2. XML Document Structure

An XML document structure is presented in the form of a sequence embedded elements (one inside the others): each element has a starting tag and an ending tag. In order to make the document structure easy to read the elements are properly indented as it is illustrated with the following example (see figure 6).

```

<paper>
.....
  <theme> Electronic library </theme>
  <authors>
    < author> Djamila Mechta</ author>
    < author> Saad Harous</ author>
    < author> Mahieddine Djoudi</ author>
  </ authors >
.....

```

Figure 6: XML Document Structure

7. Conclusion

In this paper, we have proposed an object oriented model of an electronic library. This model is designed using the object oriented modeling language UML. This library is considered as a

documentation tool to be used by learners to facilitate the comprehension of the teaching material in a distance learning environment. Different functions such as the search, the consultation and the remote downloading are available in this environment to better serve the learners. The electronic document management tool is implemented using PHP where the electronic documents are stored in a XML format. We are currently working on introducing the agents technology [10, 11] in order to provide help to the readers during their search operations [6]. In the future, we plan to integrate this tool into our virtual laboratory system [12].

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