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# DESIGNING A VIRTUAL LIBRARY DATABASE FOR CULTURAL HERITAGE AND EDUCATIONAL PURPOSES

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## Abstract

We proposed a Virtual Library (VL) based on a relational database (DB), to facilitate the online access of the students, especially from Restoration and Conservation of Sacred Art, to specific documentation, with private character, provided by an educational institute. The VL is presented like a web page, which can be accessed using any web browser (Internet Explorer, Mozilla Firefox, Opera, etc.). If the learning activity could become an Internet navigation action, then the efficiency of teaching visual arts and other related issues can be improved.

The DB is designed based on some basic principles: it must be possible to make different kinds of queries on the DB; the security of the DB is essential; users' rights must be restricted to prevent fraud; a history of the access to the VL must be stored and analysed in order to identify the attackers and the attack moments. The DB administrator knows exactly which reader has access to a resource of the VL and when it happens. Different statistics can be made based on the recorded data.

*Keywords:* database, virtual library, security, heritage, education

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## 1. Introduction

Today, Internet access is possible almost everywhere, at home or at the office, in schools and universities, even in parks, train stations and airports. The new technologies facilitate the use of the Internet services on many kinds of devices, such as personal computer (PC), notebook, mobile phone, i-phone, tablet PC or e-reader, and they are continuously evolving. So, it is an opportunity to offer the library service online, for young people, for the current and future generations of students, which are attracted by all these new devices and spend a lot of time browsing the Internet.

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If the learning activity, especially on visual arts, could use the Internet, then the educational process will be enriched. Distance is no more a problem to access the library resources, if there is a virtual library (VL) with online access [1].

Nowadays, green communications become very popular and any virtual library is welcome. The e-books and the electronic documents can have a very high graphic quality. The VL can include different audio and video files which facilitate the documentation process.

Using the VL, the visitors have a lot of benefits:

- To modify the font size or to use the electronic zoom to make the document more readable or to observe specific details of a photo;
- Fast search of a specific author or a book title or a known ISBN (International Standard Book Number);
- Efficient and fast search of books based on keywords;
- Use the VL forum to contact other readers having the same preferences on e-books;
- The possibility to contact a librarian by e-mail to obtain more information regarding the available resources of the VL on a specific subject.

The resources are categorized on many fields of interest: Economics, Engineering, fiction, juridical, Medicine, theological (alphabetically ordered). The keywords are translated in many languages to facilitate the access to different e-books, not only in Romanian but also in English, French, German, Spanish and Italian. So, the search into the VL is complex and the results could include e-books and files edited in other languages, too. Even the documents included in the VL are in different languages, not only in Romanian. All readers can ask the translation of an e-book and, if it is available, the librarian will provide it to him.

## **2. Database design**

The VL is presented like a web page, which can be accessed using any web browser (Internet Explorer, Mozilla Firefox, Opera etc.) The web page design is essential to increase the interest of the students for reading.

The VL is based on a database (DB) which manages the resources of the VL (e-books, audio and video files, photos and other documents) and also its users [2].

Anticipating a large number of simultaneously requests, the web and the DB servers must be connected to a broadband communication channel.

The DB is designed based on some basic principles:

- It must be possible to make different kinds of queries on the DB;
- The security of the DB is essential. The integrity of the documents and the availability of the VL services must be maintained no matter what;
- Users' wrights must be restricted to prevent fraud;

- A history of the access to the VL must be stored and analyzed in order to identify the attackers and the attack moments. The DB administrator knows exactly which reader has access to a resource of the VL and when it happens. Different statistics can be made based on the recorded data.

Each reader has an account and the authentication is usually made based on the username and its secret password. Using a token can significantly improve the security but this is used only if the VL owner is an institution which intends to protect its resources and restrict the access for the outsiders. In this case, a virtual private network can be implemented to secure the VL and its DB.

To monitor the 'performances' of a visitor, it may be useful to establish a score for each of them. The score is incremented each time the reader access an e-book or another document. It is useful to initiate a contest for the readers, with a short quiz of 2 or 3 questions, to evaluate the level of understanding of a book, after the reader open it, with three marks: advanced, medium or low level. The quiz is optional and the low level is the default mark. The score of a reader is raised each time with the points obtained after answering the quiz and the readers with high scores will have facilities.

The score concept stimulates reading and learning, and increases the interest for the VL, encouraging the competition between students. When they reach a certain score, students can receive a bonus card. Teachers can also use the score as information about the documentation efficiency of the student using the VL.

For the DB, we have established the entities and its attributes, and also the relations between them. Each entity is associated to a table and each attribute becomes a column of it. Some attributes are mandatory (marked by \*), others are optional (marked by °). For each entity, we choose a primary key (PK, underlined or marked by a #) and for a relation between two entities we choose a foreign key (FK).

The DB design process begins with the data analysis for the considered heritage institute (for example, a museum, a church or a heritage complex such as The Palace of Culture from Iași, Romania).

We have to classify the resources into categories: pictures, icons, statues, books, architecture elements, furniture and tapestry works, decorative objects (such as chandeliers, clocks, porcelain vase, jewels and sacred objects), cloths and so on.

An object could have one or more authors and could be restored many times so we are interested to know about the restoration and conservation dates and techniques, and keep the history of these operations.

For educational purposes, the VL will offer much information about each artist (art area, artistic currents, studies, its masters, nationality, born date and place, debut date, etc.)

Regarding the exponents included in the VL, a lot of details are considered as attributes: title, year, authors, category, type, artistic current, photo, material, estimated value, location and the installed security elements. For example, an object can be a picture and the type of it can be portrait, landscape

or biblical scene. If we are interested in icons, materials used can be canvas, wood, glass, stone or plaster.

Talking about visual arts, it is important to offer a photo of the object from a compressed JPEG file. For example, the DB includes architectural elements, pictures, sculptures, decorations and old books and their photos must be available to the visitors.

About the restoration and conservation history, the name of the persons who made it will be stored into the database. The techniques applied will also be included. An object could be restored more than one time and it is useful to know about all the operations performed on an object (painting, icon, tapestry or old book) [3].

There are a lot of many-to-many relations between the entities. For example, a book may have more than one author and an author had written more than one book. An artist could be painter, sculptor, illustrator or architect during his life, and he could belong to many artistic currents such as Impressionism, Renaissance, Gothic or Baroque. An artist could be a student and latter a teacher at a university.

The persons who access the DB could be visitors with restricted access to the DB or inside people of different kinds (librarians, curators, guardians, managers, DB administrators, system administrator) who have unrestricted rights to the DB. Different roles will be created to secure the DB.

We have to solve the many-to-many (M:M) relationships, intersecting the two involved entities into another entity, usually called 'event'.

The designed relational DB contains the following tables, with specific columns:

```
OBJECTS (#id, *title, *year, *type, *category,
°ARTISTIC_CURRENTS.id, *LOCATIONS.id, *jpeg_file, °ISBN, °editor,
°locality, °country, °language, *material, *short_description, °value)
AUTHORS (#id, *first_name, *last_name, °pseudonym, *nationality,
°origin, °born_date, °born_place, °debut_date, °master, °death_date, °comment)
CREATION_EVENT (#id, *AUTHORS.id, *OBJECTS.id)
ART_EVENTS ((#id, *AUTHORS.id, *type)
ARTISTIC_CURRENTS (# id, *current, °short_description)
MEMBERSHIP_EVENTS (#id, *AUTHORS.id, *ARTISTIC_
CURRENTS.id, *founder(y/n))
SCHOOLS (#name, °locality, °country)
ACTIVITY_EVENTS (# id, *AUTHORS.id, *SCHOOLS.name,
*start_date, °end_date, *student/teacher)
LOCATIONS (# id, *indoor/outdoor, °level, °room, °name, *manager_id)
PERSONS (# id, *first_name, *last_name, *type, *role,
*subscription_date, °email, °address, °locality, *country, °manager_id)
ACCOUNTS (# id, *username, *encrypted_password, *start_date,
°end_date, *PERSONS.id,*role)
ACCESS_EVENTS (# id, *date, *start_time, °end_time, *PERSONS.id,
*OBJECTS.id)
```

RESTORATION&CONSERVATION\_EVENTS (#id, \*OBJECTS.id, \*PERSONS.id, \*start\_date, \*LOCATIONS.id, \*technique, °cost, \*details)  
 KEYWORDS\_LIST (# id, \*k\_ro, \*k\_en, \*k\_fr, \*k\_ge, \*k\_sp, \*k\_it)  
 KEYWORDS\_OBJECTS (# id, \* KEYWORDS\_LIST.id, \*OBJECTS.id)  
 SECURITY\_ELEMENTS (# id, \*OBJECTS.id, \*type, \*installation\_date, °removal\_date, \*cost)

The Entity-Relationships Diagram (ERD) is given in Figure 1.

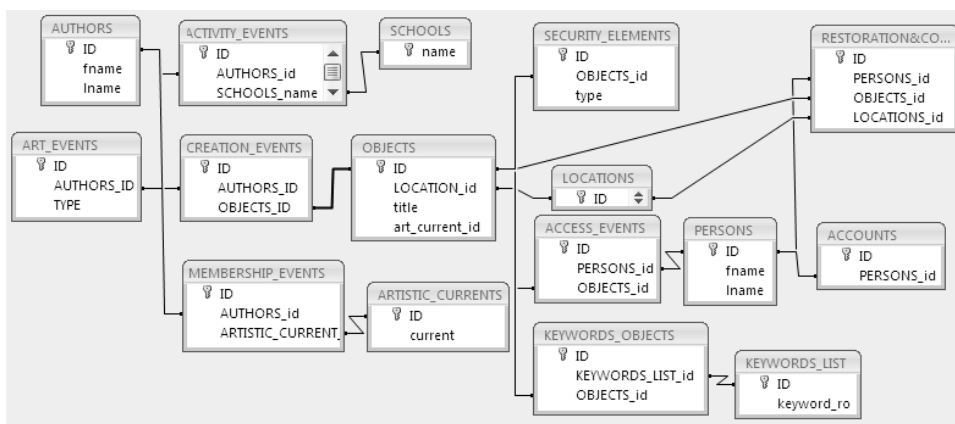


Figure 1. The Entity-Relationship Diagram of the DB.

## AUTHORS

|              |   |             |   |
|--------------|---|-------------|---|
| ID:          | <input type="text" value="1"/>          | born_place: | <input type="text" value="HUȘI"/>             |
| fname:       | <input type="text" value="STEFAN"/>     | debut_date: | <input type="text"/>                          |
| lname:       | <input type="text" value="DIMITRESCU"/> | master:     | <input type="text" value="-"/>                |
| pseudonym:   | <input type="text" value="-"/>          | death_date: | <input type="text" value="1933"/>             |
| nationality: | <input type="text" value="ROMANA"/>     | comment:    | <input type="text" value="COLEG CU TONITZA"/> |
| origin:      | <input type="text" value="ROMANA"/>     |             |   |
| born_date:   | <input type="text" value="1886"/>       |             |   |

Figure 2. Form created for authors of the art works.

Specific forms are created to introduce data into the DB of the VL (an example is given in Figure 2).

It is important to create lookup lists for the artistic currents, art areas, countries and so on, to avoid any typing errors and the erroneous or incomplete query results.

The DB application functions as a Microsoft Access application but it can be easily implemented in SQL (Structured Query Language).

### 3. Conclusions

We proposed and designed the relational database for a Virtual Library in an extended view, with more than just books, to facilitate the online access of the visitors and students to valuable objects, from different places such a heritage institute with pictures, sculptures, architecture elements and others.

The VL has many advantages [4]:

- VL is ecologic. We do not need printed copies of a book. One electronic document offers access for many people, simultaneously.
- The acquisition costs are significantly reduced.
- There are no more distances between readers and the library. Each person can access remotely the VL, anytime an Internet connection is available.
- The visitor has fast access to the resources and can operate fast search to select the art objects and to obtain more information on the artists or authors.
- Audio files can be included in the VL for visitors.
- VL can also be accessed using the locally computers installed.

Educational tools must be continuously adapted to the preferences of the new generations. The possibilities of developing the VL are almost unlimited and therefore it is conceived for both present students and for the generations to come.

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