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Medical pedagogical resources management

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Abstract

The main objective of this work is to help the management of training resources for students using a pedagogical network available at the Medical School of Rennes. With the increase of the number of connections and the number of medical documents available on this network, the management of new contents requires a lot of efforts for the webmaster. In order to improve the management of the resources, we implemented an automatic web engine for teachers, able to manage the links for the most interesting resources for their practice.

Keywords:
E-learning, medical informatics, computer assisted learning.

1. Introduction

The new projects like e-learning in medicine, or medical campus, are raising a requirement for new tools to manage up-to-date information. In the medical university of Rennes, we built a "pedagogical network" on which the professors of medicine can store an electronic version of their courses. The success of this project forced us to find a dynamic way to provide a catalogue of such resources. The teachers want a simple way to publish their pedagogical resources (without forcing them to use specific CAI) and the students want a standard tool to access this heterogeneous set of documents.

2. Background

As our project "pedagogical network" began in 1996 [1], the students can now access 525 courses on an Intranet web server. These courses can include either video sequence or moving images such as angiography, echography or endoscopy. Some of them are training resources (e.g. radiological training files [2]). These resources need also to be indexed or annotated [3]. Most parts of our resources are also available from outside. This Intranet is a successful project, as we had more than 3 000 000 hits in 2001 (from almost 270 000 hosts). After some years, the management of this set of resources was really problematic. Some students wanted to see the courses ordered by author, or by last modified date, or by title. So, for each speciality, we had to write different HTML index pages. And, when a new resource was submitted, we had to update various index pages. For another purpose, we have built a tool for management of external links (the aim was to facilitate the work of the administrator keeping an up-to-date index for external links). This tool allows storing the main information about links relational database (Oracle™) (name, address, authors, email, keywords, abstract, medical subject, etc.) with an HTML form. The form is connected to an automatic robot

browser. Starting from the URL, the automatic web engine connects to the specified sites, browses the HTML codes and automatically extracts the main information included in these pages. All the information returned is stored in the database and the result is dynamically displayed on a HTML page with text, arrays and representative logos. Because of the success of this tool and the ease to use it, we decided to adapt it for the internal resources management [4]. Now, each resource index is stored in a Database, and the index pages are dynamically displayed.

3. Goals

Before developing an e-learning tool, according to the teachers' needs, we specified the following constraints:
1) All the system has to work on the Web, even the administration of this catalogue (add, remove and update operations must be done with a Web browser)
2) Adding a new resource, in most cases, needs only to put the electronic form on our web server, and reference it on our catalogue
3) Maximum information is extracted from the resource itself (in order to make the user's work easier)
4) Administration can be decentralised
5) The access authorisation (mainly for the administrator pages) are controlled using a directory. Students and teachers can access any information from any computer (even outside the medical faculty).
6) A specific search engine will be used for full-text research.

Additional constraints were added during the development:
1)Some specialities can have up to 150 resources, so we need to organise the catalogue also by chapters (one speciality contains as many chapters as the teacher wants, like file-system directories, a chapter can contain documents or sub-chapters).
2)The tool has to take into account the Dublin Core MetaData (http://dublincore.org/)
3)This tool and our search engine will be fully integrate, in order to allow the students to look for a specific concept inside a speciality
4)A tool will help the professors to upload the courses directly on the server

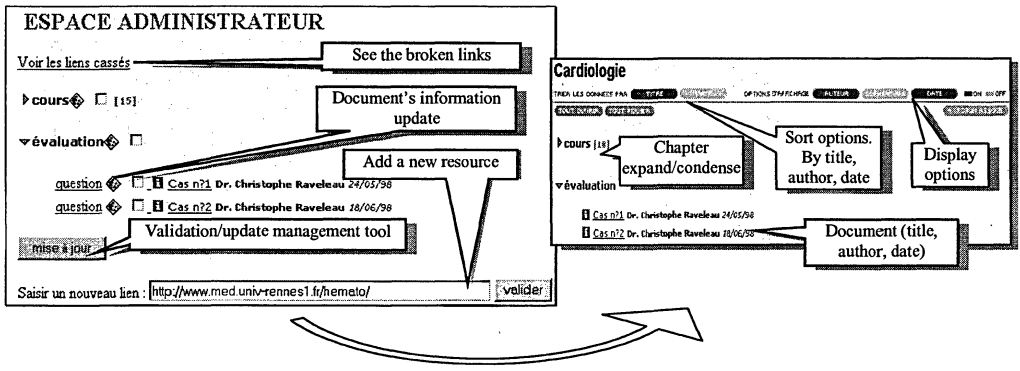
4. Material & Methods

Technical choices
Our tool uses the usual three-layer architecture: interface, development and data. We have chosen a web server (Apache™) and the CGI technology for the user interface (so our tool will be accessible from anywhere, without any special installation on the user's computer). For the data, a standard Relational DataBase Management System, which offers the power of SQL language (we curently use Oracle™, but our tool could work with MySQL™ or any other relational system). And we use the Perl language for the development, we choose it mainly for two reasons: its powerful tools to manipulate texts and web agents and its standard interface to access databases.
We use the standard HTTP authorisation process to identify the users with a login/password (which allows a teacher or a student to access the same data wherever they are). So, each access can be authorised (or not) depending on the author's profile. A directory, stored in the database, contains the profile of all identified users.

We also installed fifty five iMac™ from Apple Computer in all the units of our hospital. These computers are available only for students to access courses and medical or pedagogical contents in their practice and learning [5].

5. Results

The student accesses the catalogue with a simple web browser. The administrator, using his own login/password can access the same page with administrative options, he she also has the opportunity to add a new resource.



Administration Interface

User Interface
(same page as displayed to the user)

The administrator (teacher or assistant) upload on a server his document and fill in the form. This form is Dublin Core compliant. Next, he she has just to click on the **Submit button** to valid his indexation.

The user (student) can navigate in the hierarchy, automatically built and access easily to the document in the medical speciality. He can also perform a document search on the indexation pages included in the database.

In order to keep an up-to-date documents index, it seems important to check if the documents are still available. In this purpose we developed an automatic engine that checks (every week) if all the documents are still accessible on the web. The result is a tool that shows what are the broken links, and, optionally, when exactly the availability of the resource was checked. To improve this system, the next version will automatically send a warning e-mail to the administrator when a broken link is found.

We developed various tools for the end-user:

1) A menu, presenting the documents available per speciality
2) In a speciality, we display the chapters with a usual expand/condense interface
3) A "what's new" page, i.e. a tool that display the last updated resources available in all specialities or new information or event in the medical school. This tool is also available through a Web Interface and the administrator can add a new event from any workstation or computer connected with our pedagogical network in all the hospital.
4) A browser for each resource, displaying, on request, different information (author, date, comment, etc.)
5) A search engine is integrated, specifically created for the medical domain: NOMINDEX [6]

The administration tool was a real challenge, as we had to provide everything on a Web interface:

1) The main tool allows the insertion of a new resource. The administrator enters the URL address of his course.
2) A web agent extracts information by accessing directly the resource. It automatically retrieves available data from the Web page (using meta data, and Dublin Core if present) like the type (HTML , PDF, RTF, etc.), the language (we built a language recogniser), the author, the date, the title, etc.
3) All the information, extracted or provided by the administrator, will then be saved in the database.

In addition, we provide useful utilities for the administrator:

1) A form to enter or modify each information
2) Validation of links (for quality assessment)
3) A specific tool to manage the different chapters and specialities
4) An agent that receives e-mail with attachments (i.e. a new document), decodes the document, sends e-mail alert to the administrator asking for a validation of this new document.

This last tool allows authorised people to send a new course by e-mail, all the conversion, information extraction and validation alert to the administrator will be automatically launched.

6. Discussion

We have now more than 525 resources in the database in 11 specialities. This new version has been used for two years, and it fits the users' needs. The number of students who are using it has increased, and more and more teachers propose contents to be published on the network. We added a concept-based search engine (NOMINDEX [6]), so the users can now search indexed

documents by concept-extraction from natural language. Our directory protects us for abusive uses of the tool, only authorised users can add new documents. But the administrator can still give this right to anyone. Naturally, he keeps the right to validate (or delete) the proposed documents (the aim is to allow students to build a resource taken from a teacher's course).

Static versus dynamic pages:

Most of the search engines (Altavista, Google, Lycos, Excite, etc.) use a robot, an automatic web agent which automatically looks at web pages in order to index it on its corresponding search engine. Most of the time these robots do not parse the dynamic pages. This would be a problem in our case, as the documents will not be parsed because the index pages are dynamic. On top of that a dynamic page requires quite a lot CPU time to access the database and convert it to HTML. That is the reason why we built a "static generator tool" which generates, each morning, some static HTML pages, by mirroring the results of the CGI-Perl program. As the first index pages are often accessed, the static index pages save a lot of time, and this is a non-negligible advantage of our "static generator tool".

In order to improve the robot's indexation we are planning to build a « meta-data generator » tool: it will take the information from the database and write inside the HTML documents the « meta-data » tags. It should also automatically produce the Dublin-core Meta-tags, instantiated with MeSH terms [7], and, in the future, by semantic web information [8]. One other future project will be to read the document information from the database and, automatically, register the document on various index web servers (Yahoo, Excite, etc.).
Foreign languages

Most of the documents are available in French, nevertheless we have some resources in English. We integrate a language recogniser in our process, and a home-made automatic translation engine, which will translate only the medical concepts [6]; the translations are mainly extracted from the UMLS meta thesaurus; this tool is mainly used to index in a standard way also the documents written in another language than French, but it could also be useful for foreign students, it is able to translate the concepts in six different languages (English, German, French, Spanish, Italian and Portuguese).

We now have a standard way to access each of the resources available in the Medical School of Rennes. The teachers do not have to use a specific editor or development interface. It means that our project is flexible enough to welcome any new initiative, but can provide standard ways to publish information (like the Dublin-core [9], or the new field of web-semantic [8]).

7. Conclusion

The development of a specific tool for our purpose was quite a big job. Anyway, we have managed to build everything together with success. Before, the sites' managers were always complaining about the fact that they had at least three different HMTL pages to modify when a new document arrived. Now, the new document is automatically indexed, searchable, and checked with a minimum work. Administrators' work is easier and the use of this tool doesn't need any special training, so it is now decentralised. This server has now more than 10 000 hits

per day. Students can now access up-to-date information, they can access it by different ways (search engine, by speciality, last update tool, etc.) and the professors can easily add new resources to the server. This new version has been validated according to users needs [10] and was therefore very well accepted by students and teachers. The validation interface allows students to put a course on the server, which will be validated afterward by the professor.

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