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Managing educational resource in medicine: system design and integration

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Summary The objective of this paper is to describe our experience in developing a tool based on web technologies, for storing, managing and providing medical courses written by professors in the medical university of Rennes. The increasing number of documents sent by professors leaded us to build a specific resource management system. We created a relational database, containing all meta information about each available document. Professors provide their courses in various formats. We use natural language parsing techniques to extract information from the text, and provide a proper semantic indexation which will be used by a medical-specific search engine. Then the content of our database is dynamically displayed on a web interface. A user's directory identifies teachers and students, controls the access, tracks the students' navigation and allows an on-line discussion forum. This portal contains 524 courses and we had more than 3,000,000 connections on it last year. We are now integrating its content using the semantic web approach in a larger project: the French Virtual Medical University.

1. Introduction

The medical courses are more and more frequently available in an electronic format, the professors have easier facilities to provide their courses on a portal web site. Historically, the medical university of Rennes was one of the first French universities to provide such information (with the "pedagogical network" [1]). The first drafts were only a set of index pages containing links to each document (usually a course was a conversion from a usual text processing software to html format).

As both students and teachers successfully used this web site, the number of courses has steadily

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increased, and led us to find a dynamic way to handle this catalogue.

We did not want the teachers to write their educational resource in a specific environment (i.e. forcing them to use specific CAI or integrated e-learning platform). Our pragmatic approach gives the teacher the freedom to send his course in various forms, knowing that there is almost always a solution to convert it into a web-compliant format (html, xml, pdf, image, animation, etc.). A study like [2] tends to prove that, this approach is rather suitable for the users who prefer a usual web interface to navigate than a complex graphical user interface.

By using this strategy, one of the problems encountered is that each document lacks some crucial meta-information (i.e. author name, publication date, keywords, classification, etc.). We wanted to solve this problem by building natural language analysis tools that extracts and proposes indexation items automatically. We expect this technique to provide a standard way to index documents across disciplines. Furthermore, it gives us an opportunity to link each resource to Dublin Core [3] or to the semantic web [4].

2. Background

In 1996, we began the first "pedagogical network". The resources were initially sorted by speciality (i.e. cardiology, pneumology, etc.). Each speciality had its own html index page, with, for each course, its title, author(s) and date. For a better presentation, we also built an index page sorted by date, another sorted by author, and the last one by title. As it was well received, the teachers provided more courses to satisfy students' needs, the webmasters' work became tedious: when a new document was submitted, various index pages had to be updated manually.

At the same time, we built a tool for the management of external links [5]: the aim was to make the work of the webmasters easier by keeping an up-to-date index for external documents. This tool was storing information about external web pages in a relational database (name, address, authors, email, keywords, abstract, medical subject, etc.). The user provided the web address of a new course, then the tool launched a robot (an automatic web agent) that connects to the specified site, browses the html code and automatically extracts the main information included in this page. All the returned information was stored in the database and the result was dynamically displayed on an html page, waiting for the user's validation.

Because of the success of this external-link managing tool and its ease of use, we decided to adapt it for our pedagogical network.

3. Materials and methods

A recent article in the Lancet [6], stated that most medical schools provide extensive computer networks for their students, and these are increasingly becoming a central component of the learning and teaching environment. The web provides medical students and physicians with access to teaching resource either for initial training or continuing medical education, patient education services and communication between tutors and students. In addition, the web allows the student to access medical literature, medical software applications and medical resource knowledge bases. This medium is also used to build virtual learning modules that enhance the medical school core curriculum by including lectures, exercises, tests, clinical cases, etc.

As stated by [7], yet very few works have been published on medical school web sites, their construction process, their advantages, and drawbacks. In our system, we got away from static html pages and, as it is now required by the state of the art, we build a dynamic approach where the web content may change through user interaction. The pages are easier to maintain, and as in [8] design elements are separated from contents. According to Brandt and Nadkarni [9], an easy access to database engines and external objects is essential for a development environment to be considered viable for rapid and robust application delivery.

The main choice we made was that the whole system has to work on the web. The professors, the students and the administrators will interact with the system using usual web technologies.

3.1. Technical aspects

Technically, we have chosen the usual three-tiered architecture: interface, application and data. The user interface is managed by an Apache web server and the common gateway interface (CGI) technology. The data is stored in a standard relational database management system, which offers the power of SQL language (we currently use Oracle, but our tool could work with MySQL or any other relational system). For the application tier, all development is done in Perl language, that we have chosen because of its powerful tools to manipu-