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eLearning Libraries: Managing *rich media content* in an academic institution

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ABSTRACT

The New Media department of the Francisco Marroquín University (UFM) in Guatemala supports students and faculty in the use, creation, and management of digital resources. This paper reports the insights gained by the UFM after a three-year project that focused on the design and production of rich media content, i.e., the integration of video, text, images, and navigational devices that complement web-based and traditional learning. The toolset used for rich media development was created by nTropic, Inc. and beta-tested at the UFM. The rich media production process, as well as cataloging and digital preservation are addressed.

KEYWORDS

Rich media, streaming video, content analysis, video annotation, indexed video, XML, XSLT, multimedia cataloging, eLearning libraries.

Video in the Age of the Internet

Thanks to the advances in digital technologies, today's video cameras are inexpensive, small, and easy to operate. They require little additional lighting and are capable of recording events and lectures quite unobtrusively. From the camera video can be easily uploaded into a personal computer, where it may be edited and converted into various formats for digital distribution, including of course Internet delivery. In fact, almost anyone with a home camera, a computer, and access to a webserver can turn into a video publisher. Movie trailers, adult entertainment, and clips of newscasts have become widespread on the Web. But libraries have, in general, not yet realized the potential of Internet video. For example, the November 2003 issue of *American Libraries* describes a project run by the St. Mary's University (San Antonio, Texas) library: videotapes of important presentations are included in the collection, thus helping "preserve and catalog institutional and local history" (Duesterhoeft and Keogh, p. 49). We would like to suggest that, if these videotapes were digitized (even partially) and were available via the Web, access to this important content would grow tremendously. The library already owns the materials, but the additional steps of digitizing and posting the digitized content are yet to be taken.

Media departments and eLearning groups at many universities are already building digital audio and video collections and starting to post content online. Three main kinds of video can be found online: promotional videos and documentaries, classroom lectures posted for students who may have missed a lecture, and brief video segments to be watched as part an online course's materials. Some examples can be seen at Cal Poly Pomona (video.csupomona.edu/streaming/tae/tae_index.html) and the Massachusetts Institute of Technology (mitworld.mit.edu and web.mit.edu/smcs/8.02/). And the "24/7" university (www.247university.com) relies exclusively on streaming media for the delivery of course materials.

A piece of software known as a "player" is needed in order to watch digital videos on a computer. The most popular "players" are Microsoft's Windows Media Player, Apple's Quicktime, and Real Networks' RealOne. All are available as free downloads. They offer buttons similar to those on a television or VCR: one can adjust the volume or mute the playback, one can fast forward or backward, pause and then continue at any time. In addition there is a "slider" control that allows one to skip forward or move back by chunks of time. Figure 1 shows the Microsoft Windows Media player in use.

Figure 1. Screenshot of Microsoft Windows Media Player.

Two main modes of reproduction are possible with these players. The first is the "download" mode, where the video has to be copied in full from a server, and once it is stored on the local computer, it can start playing. This works well with short clips, but the longer the video lasts, the larger the resulting media file, and the longer it will take to download the video. The second mode is known as "streaming": as soon as the media file starts downloading, the player starts the playback. Thus, content is seen as it streams in. Waiting for the complete file to download is no longer necessary, and posting long videos (an hour or longer) becomes possible. It is still desirable to work from a fast network connection (at least 128 Kbps), as video delivered over modems and regular telephone lines tends to be of low quality.

Rich Media for eLearning

Even if videos are streaming in via the fastest Internet connection, watching them is still a linear experience: one may know how long the video will last, but not what its structure is. From the video's title, one may have an idea as to what the video will cover, but usually very little additional or significant metadata is provided. By enriching videos with texts, images, and navigational devices, the resulting product gains the functionality of a book: one can search and find a specific topic and move directly to that portion of the video, one can study the diagram shown by a lecturer in full detail, and one can make annotations or bookmark a specific section. Figure 2 shows a typical screenshot of the GLIFOS-mediaPlayer, a rich media presentation tool which was initially developed by nTropic, Inc. for the Universidad Francisco Marroquín (UFM) in Guatemala. In this example, the video is a one-hour lecture that was taped in a regular classroom. The Microsoft Windows Media Player has been embedded into a web browser window, from which its playing is synchronized with the table of contents and the PowerPoint slides appearing on the right hand side.

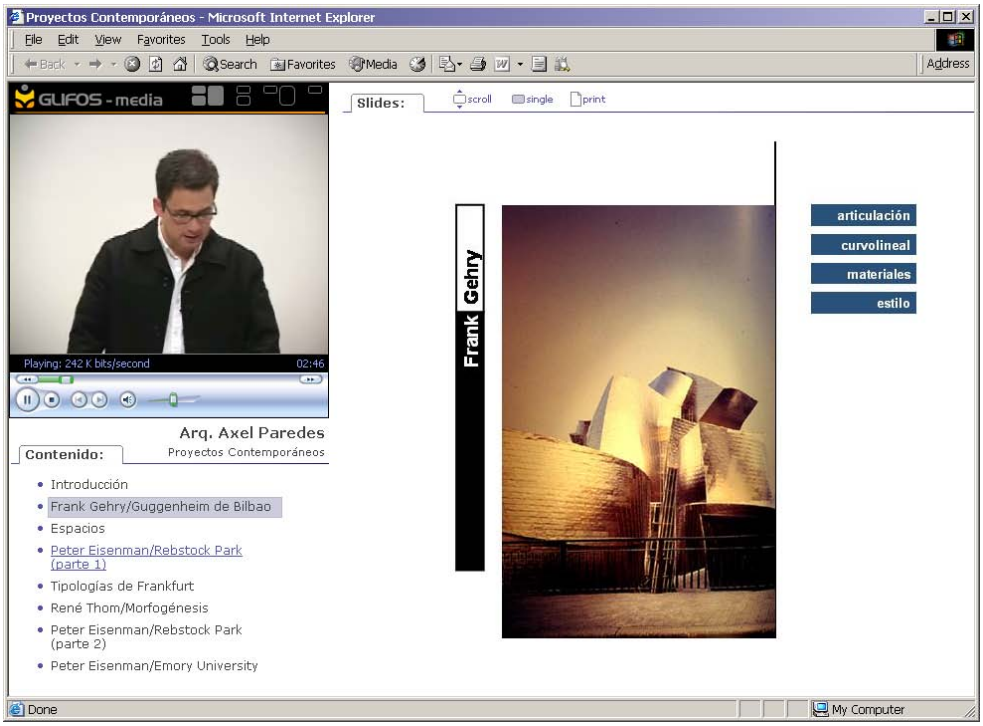

Figure 2. Screenshot of gmPlayer

The image shown above corresponds to the second lecture on "Folding in Architecture" that is part of a "Contemporary Design" course developed by New Media UFM for UFM's College of Architecture. Fourteen one-hour lectures were taped. Each was post-produced as a rich media unit and uploaded into the course website for student use. Five such full, for-credit courses are currently in use at the UFM and seven more are in preparation. Each course has between 12 and 20 hours of rich media, which are delivered via Internet or distributed on CDs or DVD-RAMs. Student feedback has been positive (Pasch, 2003a and see www.newmedia.ufm.edu/enlinea.asp), but evaluation efforts are still underway under the supervision of UFM's experts in educational psychology.

We have learned that professors react quite favorably to having their courses taped. First, all they have to do is prepare for their regular class, perhaps a little better than they usually do. We do the work of scanning and adapting handouts, PowerPoint slides, and other supporting materials, so generally they don't need to change their teaching styles. Professors appreciate this, however, it must be added that not every professor is an engaging communicator, and therefore, this method would not work for all professors. Second, since they teach in front of "real" students, they get "real" feedback and they can focus on their students' needs instead of on the camera. And third, after they get over their initial nervousness, they realize that there is a good chance that their taped lectures will outlive them. They feel honored and at the same time, they become curious about the technology.

Building Rich Media Libraries

In addition to constituting a web-based course's core materials, the rich media objects are also accessible as reference materials to students preparing for comprehensive exams, writing theses, or doing independent research. In other words, these objects stand on their own as valuable reference materials. For instance, an excellent introduction to the topic of international commerce can be used in several courses, such as economics, business, and international law. A conference taught by a visiting lecturer (e.g., Nobel prize economist Vernon Smith), who may never return to the institution, becomes a valuable academic and historic resource.

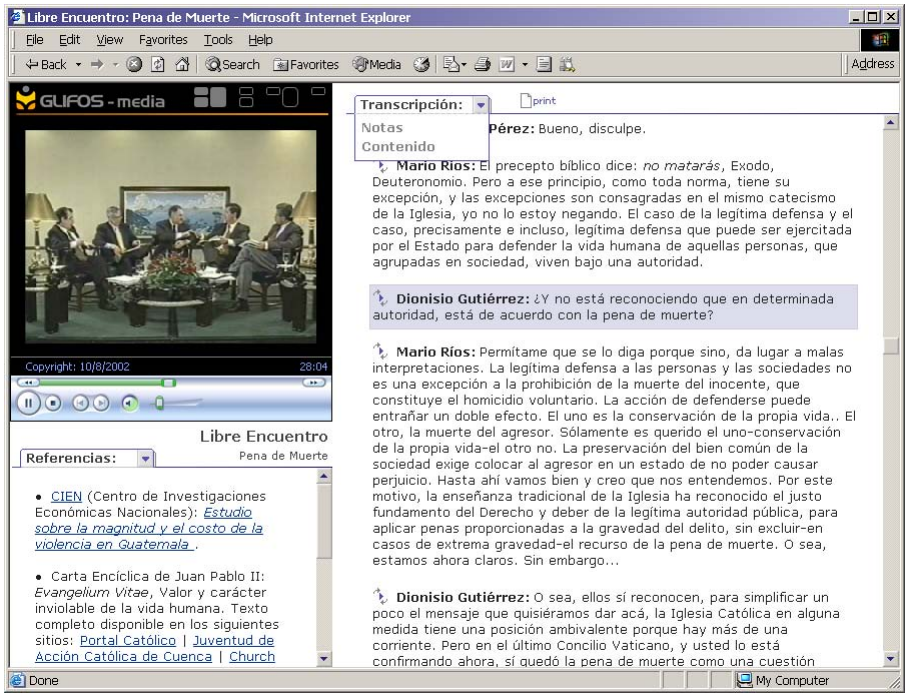

Figure 3. gmPlayer with synchronized transcript

Rich media offers several features that facilitate the use of such contents. For example, Figure 3 shows a video enriched with a transcript of the discussion. The transcript is synchronized with the video and also functions as an index. Thus, if a certain phrase or word is located in the transcript, the user can click on that paragraph to reposition the video to that point in time. The object shown has three layers on the right hand side: the transcript, a notes layer, and a table of contents. The gmPlayer allows the definition of an unlimited number of such "layers," thus one could include several transcripts in different languages, one per layer. Users can easily switch between these layers.

Users can also add their own annotations to any rich media object viewed with gmPlayer. As shown in Figure 4, the user can switch to the notes layer to type in his comments or notes associated to specific points in the video as he is watching. Later on, he can reload

his annotation file, and use the time-coded notes to navigate the video. He can also exchange annotations with fellow students. And professors can use this feature to direct students to specific points in the video.

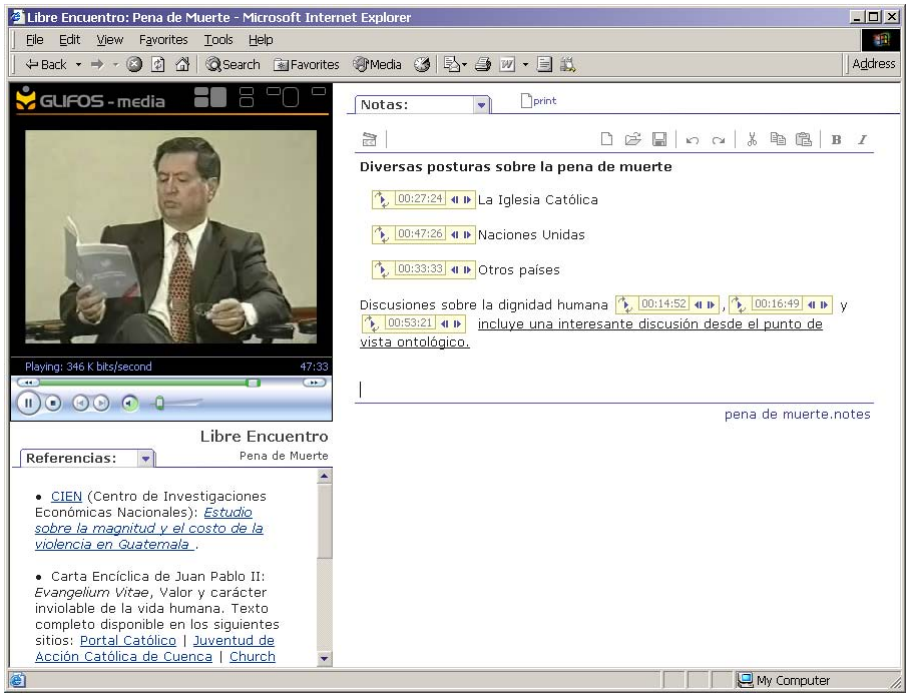

Figure 4. Video annotation, a feature available to rich media users

Rich Media Management at the UFM

In March 2001, the New Media department was formed at the Universidad Francisco Marroquín in Guatemala. New Media's mission is to support our students, professors, and staff in the use, creation, and management of digital resources. New Media provides advice on all aspects of information technology in education, including presentation design, software selection, and the detection of plagiarism in student work. Over time, New Media developed a series of continuing education courses and workshops ranging from the proper use of PowerPoint in the classroom to advanced website development and the preparation of movie scripts. But the production and use of rich media has been the main focus of the department. A dedicated staff of six equivalent FTEs work close together in the following steps of the process.

Video production. By mid-2004, New Media has three FTEs dedicated to video taping and editing. All equipment is digital: three Sony DCR-VX2000 cameras, one Sony DSR-PD150, and three TRV-25s are used for taping. Post-production is done on PCs running Windows and the SonicFoundry (now Sony Media) suite of video and sound editing software. The resulting videos are posted on a dedicated streaming server. While the production of documentaries, promos, and special events are part of New Media's work, most of the effort is concentrated on taping classes and visiting lecturers. By mid-2004,

New Media UFM has produced about 200 original videos of one-hour average length. All are accessible via the New Media UFM website (www.newmedia.ufm.edu). Since New Media UFM is the only group working on rich media for education and training in Guatemala, production services have been contracted by institutions that don't have their own production team. For example, ANACAFÉ, the Guatemalan national coffee growers association, required the creation of a series of training videos that were produced by New Media and that are available via: portal.anacafe.org

Video conversion. One FTE is dedicated to video conversions and copying. Naturally, we do not convert any copyrighted materials. Occasionally, students or faculty members may wish to convert a home-video into CD or DVD format for academic purposes. But most of the conversion efforts are concentrated on rescuing VHS tapes of local productions from the library and other collections on campus, making a usable copy, digitizing it, and posting on the New Media website for easier access. Some of the VHS tapes date from the early 1980s, and in most cases, the one copy is the only one left. About 60 videos of one-hour average length have been converted and posted on the New Media website. This may not seem much, but each video is watched by the operator, glitches in sound and image are noted and corrected when possible, and the content is documented. Among the videos that New Media re-discovered were a series of rushes of the inauguration of the new University campus, which were finally edited into a documentary. Research was done to identify the speakers and locations appearing on the video, as well as to ascertain the dates when the taping was done. Thus is addition to saving the videos, important meta-information on its contents was rescued just in time from the participants in the actual events.

Content analysis. Once the video or audio content has been digitized, it is analyzed by a group of UFM students. These students have been carefully selected for their knowledge of English and Spanish grammar and their ability to synthesize and structure the main points that a presentation covers. When a student is assigned an analysis project, he or she must make sure that the accompanying materials (such as PowerPoints or handouts that need digitization) are correct and complete. While they are working on the table of contents or full-text transcription, they have to continually check the correct spelling of names, places, and topics covered. By mid-2004, 80% of the video content posted on the New Media website has been enriched with tables of contents, transcriptions, images, and/or metadata.

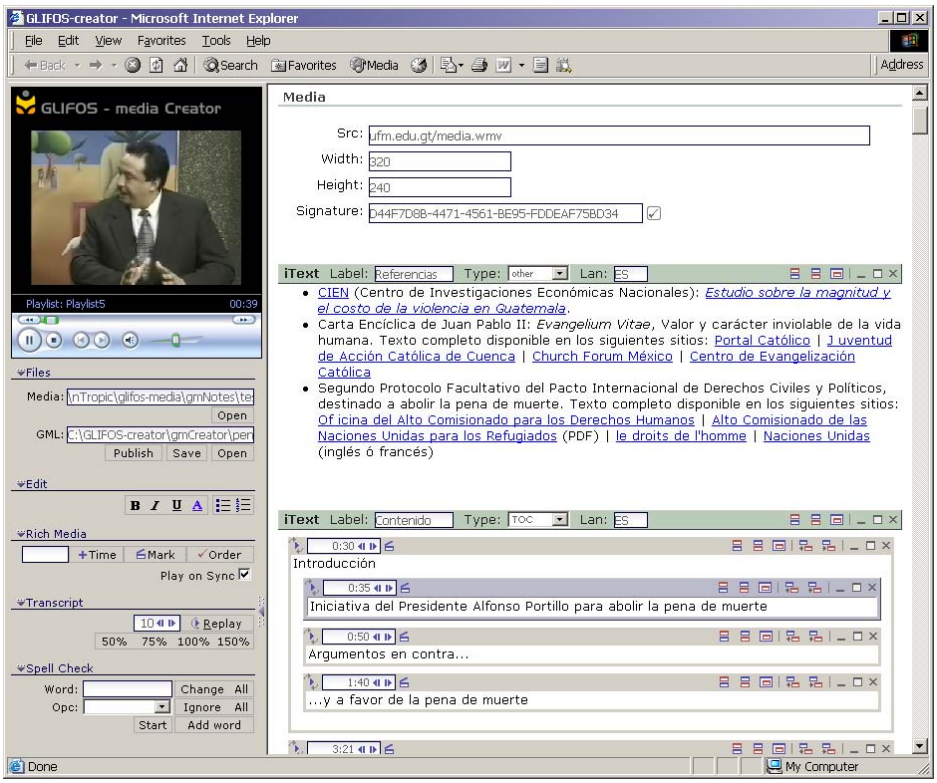

Figure 5. gmCreator tool for video indexing and synchronization

Toolset. The toolset used for rich media development was created by nTropic, Inc. and beta-tested at the UFM. This collaboration has brought benefits to the UFM, such as being able to ask for program customization that otherwise is rarely possible or very costly. For nTropic, the benefit has been to beta test their toolset in an actual production environment. In addition, the Information School at the University of Texas at Austin is also testing these tools for video captioning purposes. Figure 5 shows a screenshot of gmCreator, which is used for content analysis. While the video plays, the analyst types the index terms or transcription on the right hand side area. The timecodes are automatically inserted by the program, however, they can easily be adjusted by the analyst. The speed at which the video plays back can be selected, and hot keys facilitate pausing and moving back and forth within the video.

The gmCreator outputs a file in XML (eXtensible Markup Language) that defines the timecodes and synchronized objects for the final rich media object. None of the time information is embedded into the video files. Instead, all timecodes are saved by the indexing tool as "GML" (Glifos Media Language) XML text files, which are then rendered into a browser view.

Repurposing Content. As was mentioned earlier, preserving the metadata is as important as preserving the videos themselves. Thus, it is important to use an open specification based on XML that can guarantee content portability into the future. Our toolset allows to easily repurpose content for various platforms, such as Web, CDs,

DVDs, etc. New Media UFM started out with Real encoding for streaming videos and SMIL (Synchronized Multimedia Integration Language) indexing (Pasch & Stewart, 2002), and about 25 hours of rich media content are still in this format. The advantage of Real Player + SMIL is that rich media objects can be seen on non-Microsoft Windows computers. It also allows some additional features, such as the use of an "overlay", a semi-transparent layer that can be placed directly over the video. The disadvantage is that the functionality of SMIL is limited when compared to the rich media functionality that we have built using Microsoft Internet Explorer and the Windows Media Player. However, SMIL can be converted into GML so that the Real videos can be enriched and used via the gmPlayer.

Once the metadata is in GML, content can also be repurposed for use on palmtops or other customized browsers or applications. The key is to create the metadata and synchronization file just once, and to redeploy the rich media content as needed for current and future platforms with the help of XSLT (eXtensible Stylesheet Language Transformations) "skins" that convert the GML into browser specific displays. It is said that "multimedia content is still trying to catch up with second generation techniques" such as template and database driven page generation and stylesheet use (Ossenbruggen et.al., 2001). By using XML and metadata schemes, we are making the content machine readable and processable, an approach that is considered third generation in web-based multimedia.

Cataloging. When the rich media object is ready, it is added to the New Media online catalog and posted on the website. It becomes accessible immediately. The aggregation of three years of rich media content from courses, lectures, events, and digitized audio and visual content without an online catalog, would not be more useful that the average VHS storage closet. For this reason, the tools that we have developed mirror the traditional structure of library catalogs and indices in order to allow access to any video fragment. The online catalog finds content by its bibliographic record, metadata description, and full-text from its tables of content and transcripts, and the player takes the user directly to the related part of the video. Figure 6 shows a screenshot of a rich media object record in the media catalog.

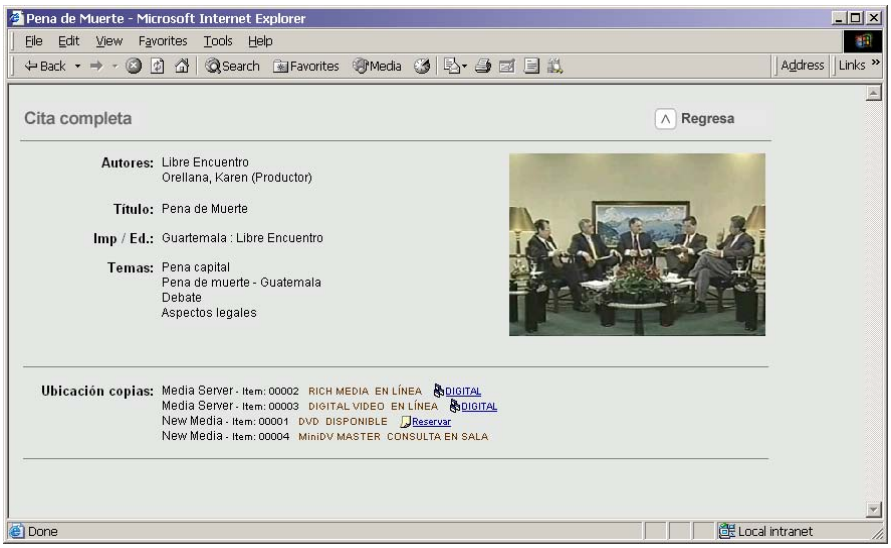

Figure 6. Rich media object record in gmLibrary

The UFM library catalog already is running on the same XML- and web-based system (www.glifos.com) that the rich media library uses. Eventually, both catalogs will become integrated, offering a single point of access to all formats already present in the library (books, manuscripts, maps, lithographs, photographs, VHS tapes, eBooks, online resources, and more). We are aware that in integrating these catalogs we will find ourselves in unexplored territory. The many metadata formats currently used for rich media are not standardized in the way that MARC21 has standardized the traditional bibliographic records in library systems (Pasch, 2003b). For example, all lecturers that are videotaped at the UFM sign a release form authorizing the recording and the educational use and distribution of the recording. This form becomes an important part of the media management, but it is related to various objects: the abstract presentation that was given, the presentation as captured on the original tape, the edited version of the presentation as stored on a master tape, the compressed version stored on the server, and the streaming presentation delivered as rich media to the final user. As yet, there is no model in library and information science that satisfactorily ties together such "expressions" of the presentation and its ownership, management and control data. But as the OCLC E-Learning Task Force (2003) has concluded, even if no standards are yet in place, "practical efforts (and experiments) need to proceed despite the lack of current industry uniformity and the possibility of occasional failures" (p.2).

On Future Research

As we worked on creating rich media objects, we came across many suggestions for improving our toolset and for refining the functionality offered to users. Three ideas that we are developing are the use of voice transcription, the sharing of annotations, and fine-grained retrieval. Well documented problems with automatic speech recognition (Hürst, 2003) could be solved in part by using voice instead of textual transcriptions. This idea, proposed by Quinn Stewart, who is testing the gmToolset at the University of Texas School of Information School, is now being developed by nTropic. In order to make user annotations more useful, we are looking into ways of integrating such annotations into the rich media

catalog. For example, we can collect the times that are being marked, and identify time ranges that have been so noted. These could turn out to be, for example, sections that are hard to understand, or that have important contents, or simply those where the audio fails or the professor walks out of the frame (which may happen sometimes!) Fine-grained retrieval refers to using the highly semantic content of the rich media objects built by human analysts at the UFM to do more detailed cataloging and more accurate retrieval of video segments.

Another important research area is the use of rich media technology by illiterate persons. For example, hundreds of Guatemalan coffee growers who don't speak Spanish and that are also illiterate in their own language are in urgent need of training in plague control. At this time, there is only one instructor trained in coffee-growing who can speak the Kanjobal language. Reaching all coffee growers who would benefit from his knowledge would be impossible, since there are no resources, and especially there is no time for him to offer enough face to face training sessions. Instead, coffee growers can come to the regional training centers to access the rich media contents on their own schedule. So our first attempt for delivering rich media to them will start with thumbnails and icons that index directly to specific segments in the video. The images may mean nothing to the user, but upon clicking on them (or pointing on a touchscreen) he will hear an audio description in Kanjobal for the related topic. The second click will actually synchronize the media to the specific video segment. After a few tries the user will know what the icon stands for and will not need to wait for the audio description provided by the gmPlayer. We are currently designing a prototype, and testing should begin by the end of 2004.

Conclusions

As of this writing, we do not know of any other universities that are delivering regular courses in the form of rich media. One reason may be that the available tools for developing rich media tend to be expensive. That was the motivation for the UFM partnership with nTropic, the local software development company that developed the ad-hoc toolset for rich media creation and management. Doing so has provided both parties with the unique opportunity of studying the effectiveness of rich media in web-based teaching.

Throughout our work, we are inspired by the fact that libraries have always been "multimedia" repositories of books, maps, photographs, videotapes, CDs, and much more. For centuries, libraries have enabled the process of discovery by allowing everyone to search and relate information in all disciplines, in novel and unforeseeable ways. We believe that this role can be played now by our rich media online catalog, in a way that goes beyond supporting eLearning. In the classroom and in eLearning, the emphasis is on guiding the student through a limited maze of contents. But both the traditional and the rich media library break the limitations imposed by planned direction and constitute a learning tool for the self motivated, innovative, and independent thinker.

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