IBM Research Report

ELM-N: E-Learning Media Navigator

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and converts them into formats suitable for Web access and delivery. The BMRC lecture browser from Berkeley Multimedia Research Center is an interface for browsing lecture-based multimedia content over a large range of available bandwidths. It enables a user to browse a media-rich presentation and navigate within it by allowing random access to different sections of an online lecture or presentation through hyperlinked slides.

The main features of the ELM-N system are similar to those provided by the eClass and the BMRC lecture browser systems with key differences and novel value-adds that we will describe and demonstrate. Like the other two systems, ELM-N allows random access and navigation of online courses via slides and their thumbnail images through hyperlinks. It presents the audio-video stream of the captured course in a time-synchronized fashion with the associated slides and white board content. But the main differences and enhancements of ELM-N compared to the other two systems arise from our focus on a generic infrastructure for capturing different types of online courses, and on employing content analysis for structuring the captured material to generate enhanced and augmented navigation interfaces automatically.

4. MEDIA ANALYSIS AND NAVIGATION

In ELM-N, the media content is analyzed and structured to provide a rich interactive experience to a user. The main features of ELM-N are the following:

- **Generic Infrastructure:** ELM-N provides a generic infrastructure to acquire and process different types of online courses. Two main types of online courses are addressed by ELM-N. In the first type, a course is created in a professional studio setting with video and audio equipment where an instructor presents the material with or without slides. In the second type, a seminar or classroom lecture is captured with less stringent requirements on audio and video quality. The difference in the quality of the two types of captured courses and the variation in the arrangement and settings under which the courses are produced, necessitate that a generic infrastructure be designed and built for the tasks of acquisition, analysis, and delivery of the online material.

- **Content-based Structuring:** ELM-N employs content analysis techniques to analyze the audiovisual material and automatically structure the media. Automated media analysis includes detecting slides and slide changes in a captured course, recognizing the text in the slides, detecting topics and subtopics of the presented material, detecting highlighted regions of interest, recognizing salient content in the white board material etc. The analysis results are used to structure the media content and automatically generate a table of contents for navigation.

- **Augmented Navigation:** The structured media content is presented to the user with multiple indexes and augmented navigation aids. A user can access the online course through a table of contents generated automatically, or search for specific topics, slides, or white board content. The synchronized presentation of audio, video, slides, and white board material allows a user to navigate the course material in a cross-referenced and time-synchronized manner.

The above features of ELM-N are realized through a set of software modules for media acquisition, analysis, structuring, and delivery. The demonstration will present these capabilities and the underlying research technologies that enable them.

5. SUMMARY

E-learning is changing the way education and training are being offered and consumed by universities and corporations. ELM-N is an e-learning media navigator that enables a user to access and interact with online courses presented as audiovisual material along with related slides and white board contents in a time-synchronized fashion. The system employs content analysis techniques to structure the captured media and generate augmented navigation interfaces automatically. The demonstration will present the system capabilities and the research technologies behind them.

6. REFERENCES

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in addition to the lecturer's voice. The system integrates several media and organizes as Web pages for access and study.

The BMRC lecture browser [5] is a web-based tool providing access to streaming video and synchronized slides used in courses. Various media elements collected during a lecture are managed in a database and can be searched and retrieved by the user. It uses the RealNetworks, RealPlayer for streaming audiovisual material. It also allows for slide search independently of the lecture video.

Currently E-seminar and other lecture browsers are manually annotated involving a large investment of time and labor. The goals of our E-Learning Media Navigator (ELM-N) are to reduce human effort and manual annotation, and to support functions such as content-based access, easy navigation of the medium in terms of automatically structured content, and topic-driven browsing. Our work targets automatic indexing of content and its organization into useful, easy-to-use access structures beyond today's story boards that are voluminous.

Towards that goal, technologies are being developed at IBM Research [3] to (i) parse and structure media content with an ability to automatically establish semantical relationships between the various elements (such as audio, slides, white boards, and video) in the content and derive thematic access structures for concise, but expandable organization and (ii) develop joint audiovisual algorithms that deliver multi-layered concept-oriented content descriptions that are parsimonious as opposed to existing verbose low-level features such as shots, key frames, or keywords form speech for search. Such an ability will lead to provision of easy-to-use aggregate to fine-grained media search and browsing services. The ELM-N interface is currently implemented using SMIL 1.0 and QuickTime 5. Figure 1 shows a snapshot of our system illustrating its current capabilities.
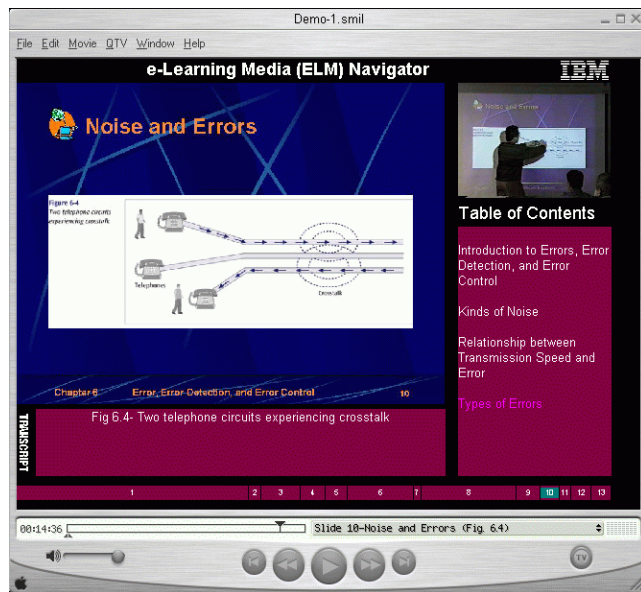

Figure 1: A snapshot from E-Learning Media Navigator.

4. CONCLUSION

The highlights of the ELM-N system are the following: (i) Independent video, audio, and slide access and browsing; (ii) slide-timeline mediated audio/video access; (iii) slide indexed course and lecture browser; (iv) time synchronized speaker transcript with slide browsing; and (v) structured video Table of Contents for navigation. In this demonstration, research technologies behind these capabilities will be presented and experimental use-cases will be discussed.

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