Web Lecture Capture System

First six months of activity

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People

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Project Goals

• Develop a compact, inexpensive, robust hardware device to capture the audio/video and slides from a presentation, archive this data, and post it on the web as a “web lecture”.

• Build a tracking camera system to follow the speaker, eliminating the need for a camera operator.

• Develop an automatic metadata extraction system so that date, time, keyword and other information could be extracted from each presentation, wedded to the recorded lecture, and entered into a database that could be globally shared.
Project Goals (cont)

- Design and develop a proposed global standard for an entity called the "Lecture Object" that would permit recorded lectures to be accessed and replayed by essentially any user for decades to come, independent of changes in commercial applications.

- Enhance the capture, processing, archiving and publishing software applications to make them more robust and efficient.
Prototype #1

Out first task was to build a portable, rugged, re-configurable system for field-testing our ideas.

It consists of a 2’ x 3’ x 4’ shock-mount rack-case, loaded with the following:
- Two high-performance PC’s connected via intranet
- VisionRGB VGA capture card, A/V capture card
- Audio mixers, power strip, KVM switch, fold-out keyboard and monitor
- Equipment drawer (mics, cables, etc)

Prototype #1 was completed in December 2003, and used to record the San Diego conference in Jan 2004.

Next prototype should be substantially smaller and easier to set up.
Software Modules Written

• Our proposed Web Lecture Capture System requires the development of many software modules. We have written and are continuing to develop the following:
  – Control Application (Visual Basic)
  – Process Managers
    • Slide Capture (C++)
    • Audio/Video Capture (Visual Basic)
    • Robot Camera (C++)
  – Data Merge / Lecture Object Creation (Perl)
  – Additional Processing (Perl)
  – Publishing (Java) *(written before this grant started)*
  – Metadata Entry (PHP)
  – Browsing the archive (PHP)
Lecture Object

• Our open standard for archiving and transporting lectures and courses. Essentially a “zip file” containing all media in very high-resolution, non-proprietary formats, along with extensive metadata and timing information organized using established standards.

• All metadata are stored in a MySQL database, which we are developing mindful of needed compatibility with the CERN Agenda system and APS archiving practices.

• When exported from our local database, a Lecture Object consists of 2 XML files: lecture.xml and metadata.xml, and standard directory structure.

• Standards used:
  – Dublin Core
  – Learning Object Metadata
  – vCard
  – RDF/XML
San Diego Test

- We set our first milestone to be the recording of the January 2004 APS Conference “Opportunities in Biology for Physicists II”, consisting of 13 talks.
- Completed Prototype #1 and capture/archiving software, and shipped both to San Diego
- Recorded, processed, archived, published all 13 talks within 24 hours of occurrence
- Manpower: 1 camera operator, 1 “expert”
- Once various small hitches were overcome in the first few talks, the “expert” hardly needed to intervene at all. We consider this milestone to be a complete success.
- The lectures are available at:
Robotic Camera System

• We proposed to investigate the possibility of replacing the human camera operator with a robotic camera system, which would radically improve the scalability of the project, and make recording all parallel sessions at a national meeting of the APS a real possibility.
• We purchased a WiFi-based RF tag location system from BlueSoft - $6K
• We wrote software (Visual C++) to read tag location from the BlueSoft API, and control the camera accordingly through its API
• Initial tests inconclusive – small indoor environments experience substantial RF reflections. We will test it in the large lecture hall at the APS May Meeting in Denver.
Other Ideas for Robotic Camera System

• We are investigating other possibilities for building a robust system that can smoothly track the speaker, alternating between upper-torso shots and facial close-ups, and panning to audience when there are questions.
  – Ultra Wide Band RF tag location system
  – IR LED beacon necklace
  – Webcam necklace
  – Redundant simultaneous systems
    • RF location system
    • Camera’s built-in face tracking
    • Ultrasound? IR LEDs?
Denver and Rest of Summer

- May APS Meeting in Denver
  - Record/publish the nine plenary talks
  - Improved software = less expert intervention
  - Initial robotic camera test, with extensive logging for later analysis

- Rest of Summer
  - Solidify Lecture Object standard
  - Tighten integration with CERN Agenda System
  - Capturing chalkboard/transparencies
  - QuickTime, Flash, DVD lectures
Potential Year-2 Initiatives Under Discussion

- Make the WLCD robust and easy to set up/operate
- Shrink the size of the WLCD.
- Make transparencies as easy to capture as PowerPoint slides
- Develop a robotic camera to completely replace a human operator
- Continue Lecture Object development to make the standard more generalized, and compatible with more existing standards
- Study educational uses of web lectures
- Integration with Course Tools, Sakai
- Integration with collaborative tools needed by large scientific collaborations (e.g. GECSR)
- Recording and streaming lectures over AccessGrid
- Speech extraction/tagging and OCR, using DAMS lab at U-M
- Use GRID to do various processing tasks
- PocketPC lectures
The University of Michigan, Indiana University, MIT, Stanford, the uPortal Consortium, and the Open Knowledge Initiative (OKI) are joining forces to integrate and synchronize their considerable educational software into a modular, pre-integrated collection of open source tools.

Major efforts like this will need capabilities such as we are developing.

Chuck Severance of U-M (co-PI) has a major role in this effort.

http://www.sakaiproject.org
DAMS

• A joint project of U-M with IBM on a Digital Asset Management System (DAMS)
• Promises ability to search through a video looking for the mention of specific words, or when a particular face appears.
• The system integrates ingestion of data, assignment of metadata, storage, retrieval and manipulation.
• http://sitemaker.umich.edu/dams
Other Ideas

• Synergy with GECSR
• Fedora Digital Library
• Stream lectures over AccessGrid (AG currently lacks VGA-desktop sharing)
• Integration with U-M Course Tools
• Use GRID for video processing
• PocketPC lectures
• P2P distributed storage/distribution (like Kazaa)