Multimedia Systems and Applications

Introduction

James Wang

What is Multimedia?

- Apps that involve more than conventional data types (e.g., text, drawing and images)
- Best examples are continuous media (e.g., animations, audio, and video)
  - Called continuous media because of its temporal nature
- Do not confuse with hypertext/hypermedia
  - Hyper implies linking
- Eventually all apps will include hypermedia
- The World Wide Web (WWW) is the best example of hypermedia applications

Multimedia Applications

- Hypermedia courseware
- Video-on-demand
- Interactive television
- Audio/video conferencing (GroupWare)
- Virtual worlds (http://www.activeworlds.com)
- Games
- Multimedia authoring
- Digital libraries
- Web
- Audio/video postproduction
- More ...

Why are we here?

- We are here to learn something that has been hot for years.
- Why Multimedia is so hot?
  - It is fun!!!
  - Interesting technique issues.
  - Huge application potential.
  - Digital audio and video is revolutionizing music, film, and video industries.
  - Collaboration, virtual environments, and web casting.
- How hard is Multimedia?
  - It is easy and fun when you look outside in.
  - It is hard and boring when you look inside out.

Course Objectives

- This course will provide the students with an overview of multimedia technologies and the latest developments in multimedia systems.
- Students will be able to gain valuable hands on experience in multimedia systems and applications.
- Issues in effectively representing, processing, and retrieving multimedia data will also be addressed
- Recent multimedia papers or technique reports will be presented or assigned as homework
- Upon completion of the class, the students will be able to:
  - Comprehend multimedia system fundamentals
  - Design and implement a multimedia application or identify a problem in certain multimedia area and provide a reasonable solution.

Attribution

- Materials and lecture notes in this course are adapted from various sources, including the authors of the textbook and references, Internet, instructor’s personal notes, instructor's friends, etc.
- The instructor has tried to attribute all authors of the course materials.
- If you think that the instructor may overlook something, please tell the instructor.
The word “multimedia” has been overused to the point it does not mean anything. This course will cover a lot of topics such that I will not get into details for every topics. It is your responsibility to dig into the references for details. Some topics in this course are so young that it might not have a best solution yet. Hard work is essential to succeed in this course.

Audio/Video Fundamentals
- Human visual/auditory system and perception
- Video representations (analog and digital)
- Audio representations (analog and digital)
- Media processing algorithms

Signal Processing and Compression
- Image Compression (JPEG)
- Standard video CODEC’s (MJPEG, MPEG, H.26x)
- HDTV (ATSC standard)
- Layered source/channel coding
- Standard audio CODEC’s (MP3, G.72x, AC3)

Operating System Support
- Real-time scheduling
- Buffer management
- File systems
- Cache and storage systems

Network Support
- Network hardware (Sonet, ATM, Ethernet, and 1394/Link)
- Network protocols (link-level resource management, IP-multicast, RTP, SIP, etc.)
- Systems services (e.g., continuous media toolkits, announce/listen protocols, receiver-oriented layered multicast, resource discovery, etc.)

Web Technologies
- Web Server and Web Caching
- Multimedia streaming
- X3D/VRML, XML
- Multimedia content delivery

Multimedia Databases
- Large-scale multimedia servers
- Content based multimedia retrieval
- Multimedia data mining

Synchronization
- Synchronization models
- Static -vs- dynamic schedules
- Distributed collaboration

Class web:
http://www.cs.clemson.edu/~jzwang/ustc11/ustc11.htm

Class hours:
- Check the course website.

Classroom:
- 324 Mingde Building.

Office hours:
- Any time other than class hours (by appointment only).

Q&A:
- Send questions to jwang@cs.clemson.edu.

Attendance
It is very important to attend the class since the lecture contents are drawn from various sources. Failure to attend the course most likely leads to missing some information that won’t show in lecture notes or textbook. The students may leave if the instructor does not show up in the classroom by 5:15 PM.
The instructor will provide several multimedia-related projects at the beginning of the semester for students to choose from. The students should form teams of 2 to 3 persons by their own choice. Any student who fails to find a team should contact the instructor as soon as possible to avoid any delay in the project. Each team can choose one project from those provided by the instructor to work on. A team can also work on a project they propose upon the approval of the instructor.

Each team must finish the project independently. Any form of cheating will result in a grade F in the course for anybody involved. Projects must be submitted before the due date. Late submission will not be accepted unless being approved by instructor.

Test (60%): There will be a written exam at the end of the semester to cover the content studied in the class. Project (40%): Each team must submit a project report and give a demo at the end of semester. The project report must include the project design, system architecture, implementation details, source code, installation instruction and user manual. Penalty Points (-10%): Students are required to attend the class. The instructor may penalize those who fail to attend the class without instructor's approval. Grading: A (90 - 100), B (80 - 89), C (70 - 79), D (60 - 69), F (0 - 59) (The scale may be curved down at the end of the semester).

ACM Multimedia Conference Proceedings
Web Caching and Replication, Michael Rabinovich and Oliver Spatscheck, Addison-Wesley, 2002.