Course Overview
Multimedia Computing

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Outline

- Definition of multimedia
- Purpose of multimedia
- Applications of multimedia
- Technical challenges of multimedia
- Course outline
- Course administration information

Definition of multimedia

- Development, integration, and delivery of any combination of text, graphics, animations, sound, or video through a computer.
  - refers to content that uses a combination of different content forms
    - text, audio, still images, animation, video, or interactive content forms
  - as opposed to media that use only rudimentary computer displays such as text-only or traditional forms of printed or hand-produced material
- Convergence of multiple disciplines
  - graphics, visualization, HCI, computer vision, data compression, graph theory, networking, database systems
  - keynote interactivity

Purpose of multimedia

- Better representation of information by using audio/video/animation rather than by only using text, images and graphics.
- Collaboration and virtual environments.
  - Geographically based, real-time augmented-reality, massively multiplayer online video games
- Potential for improving our lives (e.g., learning, entertainment, and work).
  - Cooperative education environments that allow schoolchildren to share a single educational game using two mice at once that pass control back and forth
- High Market Demand!
  - Major driver of Computer Technology

Research areas

- **Multimedia processing and coding. (compression, content based analysis, content based retrival, security)**
- **Multimedia system support and networking. (protocols, operating systems, servers, clients, databases, storage media)**
- **Multimedia tools, end systems, and applications. (hypermedia systems, user interfaces, multimodal interaction and integration, education, collaborative learning and design, virtual environments)**

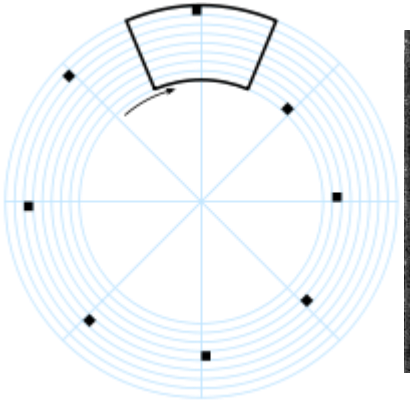
Evolution of basic forms of multimedia

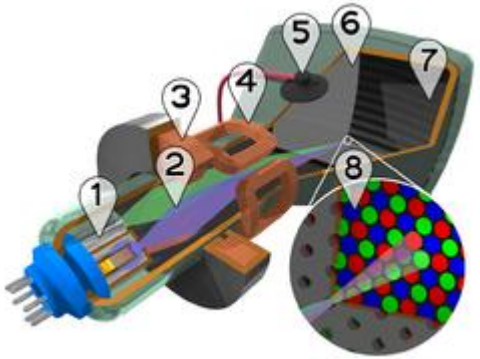
- Audio




-phonautograph (1850's)
-phonograph cylinder (1870's)
-gramaphone disc (1880's-1980's)
-magnetic tape (invented 1930's)
-cassette, 8-track cartridge (1960's)
-CD (1982)

- Video



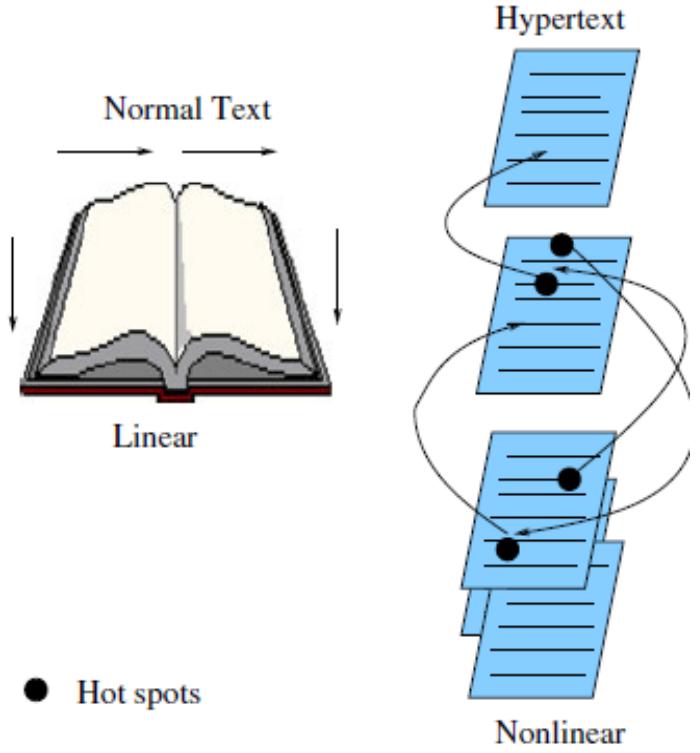



1. Three electron guns (for red, green, and blue phosphor dots)
2. Electron beams
3. Focusing coils
4. Deflection coils
5. Anode connection
6. Mask for separating beams for red, green, and blue part of displayed image
7. Phosphor layer with red, green, and blue zones
8. Close-up of the phosphor-coated inner side of the screen

-Nipkow's disk (1884)
-Baird's video scanning/transmission system (1925)
-Electronic TV (deflecting cathode rays) J.J. Thompson 1897, Rosing 1907
-Color TV (Le Blanc 1880, Adamian 1907)
-Digital TV (1990's)
-Smart TV (connected TV, patented 1994)

Linear medium versus hyper medium

- Book vs. hypertext
  - Links allow nonlinear traversal over hypertext
- Hypermedia
  - includes a wide array of media such as graphics, images and especially continuous media like sound and video and links them together
  - WWW : founded by approval from CERN
    - HTML : human readable format/language for pages that identify structure and elements, based on ASCII
      - Uses tags to describe document elements
    - HTTP



XML

- Tags (structure) and their relationship to each other defined in one place, data defined in another place, rendering of tags defined in yet another document
- Global DTD (document type definition) rules for type of data
- Server side script abides by DTD rules to generate XML
- XML looks best on different devices on client side.
- XML protocol is used to exchange information between processes, like HTTP
- XML Schema – more structured, uses XML tags for type definitions

Applications

- Enabling Technologies : Embedded system, RTOS, 802.11, 802.16, UWB, UMTS/CDMA, Bluetooth, MPEG
- Mobile

Applications

- Games

Applications

- Wearable computers (CybergLog, GoogleGlass, iWatch)

Applications

Residential Services

- Education

- Video on demand

- Commerce

- Multimedia conference

Applications

Business services

- Training

- Remote monitoring

- Multimedia conferencing

Applications

Remote presence

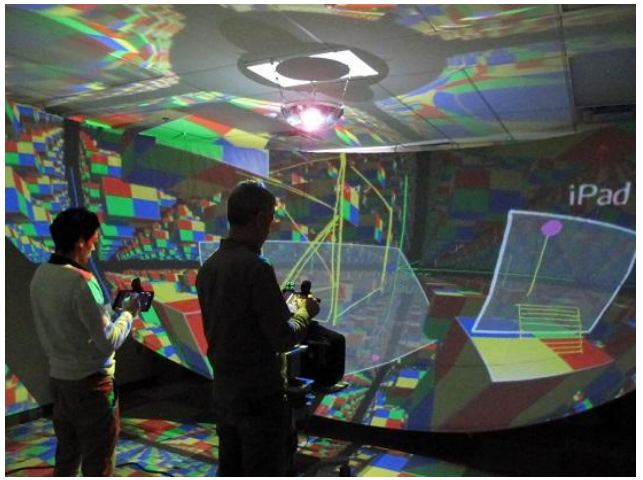
- Medical supervision

Applications

Virtual immersive environments

- As if there (entertainment)

- As if there (design-collaboration)



Other multimedia applications

- Science and Technology
  - Computational visualization and prototyping.
  - Astronomy, environmental science: efficient access to large number of satellite images.
- Medicine
  - Diagnosis and treatment - e.g., multimedia databases that provide support for queries on scanned images, X-rays, assessments, response, etc.

Challenges

- Process high volumes of data
  - Speedy, realtime
- Combine traditional media (text, images) as well as continuous media (audio/video) in the same context
- Interact with content
- Communicate data across networks that makes no QOS guarantees about
  - End-to-end delay,
  - Jitter (Variation of packet delay within a packet stream)
  - Bandwidth.
  - Packet loss
- Key technologies to develop for computation, communication, and storage.

Volume of data for different media

	Characteristics	BW Required
Speech	8000 samples/s, 1 byte/sample	8 Kbytes/s or 64 Kbps
CD Audio	44,100 samples/s, 2 bytes/sample, stereo	176.4 Kbytes/s or 1.41 Mbps
Satellite Imagery	180×180 km^2 30 m^2 resolution	600 Mbytes/image (60 MB, compressed)
NTSC Video	30 fps, 640×480 pixels, 3 bytes/pixel	27.6 Mbytes/s or 221.2 Mbps (2-8 Mbps, compressed)
HD video	60 fps, 1920×1080 pixels, 3 bytes/pixel	373.2 Mbytes/s or 2.99 Gbps (15-30 Mbps, compressed)

Course Outline
(Mostly coding/compression oriented)

- Introduction
- Audio/Image/Video Representation
- Basic Coding & Compression Techniques
- Image compression
- Video compression
- Audio compression
- Multimedia Networking
- Content based retrieval

Course information

- Administration web site
  - http://ninova.itu.edu.tr
- Textbook:
  - *Fundamentals of Multimedia*, by Li and Drew, 2014, 2nd edition, Springer International Publishing.
- Reference book:
  - *Computer Networking: A Top-Down Approach Featuring the Internet, 4th Edition*, by Kurose and Ross, 2008, Addison Wesley.
  - *Internetworking Multimedia*, by Crowcroft, Handley, and Wakeman, 1999, Morgan Kaufmann Publishers

Course information

- Office Hours: MW 9:00-10:00 and by appointment.
- Grading Policy:
- Short exams (10%)
- 1 midterm, 1 final (25%+40%)
- Final project and presentation (25%)

Final Project and Presentation

- Work in groups of 2.
  - Start early! Doing background work is more than half the work.
- 25% of the grade!
- Types of projects:
  - Implementation/Demo
- Project Proposal to be submitted by latest 5th week (no proposals accepted afterwards)
- Presentation will be done in the last 2 week(s) of class. (20 minutes each group)
- All group members must be involved in the presentation.
- Final report due during finals week.