CONCEPTS OF MULTIMEDIA PROCESSING AND TRANSMISSION

CSIT 402

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COURSE DESCRIPTION

- This course introduces students to the theory and principles of design and production processes of developing interactive Multimedia, a combination of text, sound, animation, graphics, and video.
- The course offers students an overview of the area of Multimedia processing and transfer through computer networks and further explores foundations of audio and video acquisition including the principles of acquisition of devices.
- Students will be given an opportunity to work with a variety of Multimedia software including programs used for sound and video production, Multimedia presentations & image editing.
- Students will also be exposed to the various compression algorithms for Multimedia processing

GOAL OF THE COURSE

The goal of this course is to provide students with a complete body of knowledge on fundamental theories, principles and technologies used in the processing, production and transmission of Multimedia.

LEARNING OUTCOMES

At the end of the course, students should be able to;

- Understand the concepts and processes which underpin the design and development of Multimedia products.
- Understand issues in representing, processing, and transmitting Multimedia data
- Understand the techniques and technologies used in the development of Multimedia solutions.
- Understand and explain principles of audio and video coding.

LEARNING OUTCOMES CONT'

- Understand and apply various compression algorithms to compress multimedia data
- Use appropriate tools for the design, development and creation of digital media artefacts.
- Gain hands-on experience in image, sound and video editing and in some aspects of multimedia authoring.
- Create a suitable multimedia product using knowledge gain in this course

MODE OF DELIVERY

- This course will be delivered largely through face-to-face interactions.
- All resources and lecture materials for the course will be made available on the Sakai platform.
- However, few periods of online meetings would be held with students when the need arises.

MODE OF DELIVERY

Instructional methods

The course presentation include lectures, lab sessions and student presentations.

Lectures will concentrate on the general principles of Multimedia systems, while labs will focus on the practical implementation of Multimedia authoring using available software tools

COURSE EVALUATION

The assessment of students on this course will be constituted by the following components:

COMPONENTS OF THE GRADING SYSTEM	
Grading component	Percentage (%)
Assignments	10%
Lab session	10%
Mid Semester Examination	20%
End-of-Semester Examination	60%
	100%

OVERVIEW OF TOPICS

- Introduction to multimedia concept
- Historical development of Multimedia
- Multimedia Components/ Elements
- Multimedia Applications
- Multimedia Classification
- Multimedia Authoring
- Multimedia Editing
- Multimedia Representation
- Hypermedia

COURSE OVERVIEW

- Digitization and Quantization
- Multimedia transmission and broadcasting
- Multimedia Similarity
- Multimedia Indexing / Indexing tools
- Data mining
- Multimedia compression algorithms
- Multimedia compression standards
- Multimedia production
- Multimdia presentation

Referenced Text

1. Fundamentals of Multimedia by Z. M. Li and M. S. Drew, Prentice Hall (2004), ISBN: 0-13-127256-X
2. Digital Multimedia by N. Chapman and J. Chapman. 2nd Edition, Wiley 2004, ISBN: 0-470-85890-7
3. The Technology of Video and Audio Streaming by David Austerberry, Focal Press; 2nd Edition (2004). ISBN-10: 0240805801
4. Multimedia Computing by Daniel Cunliffe and Geoff Elliott, Lexden Publishing Ltd (2005). ISBN-10: 1904995055
5. Multimedia communication; Applications, networks, protocols and standards, Fred Halsall, Addison-Wesley; 1st Edition (2012), ISBEN :0-201-39818-4

SESSION_1: INTRODUCTION TO MULTIMEDIA

MULTIMEDIA CONCEPTS

What is Multimedia?

Multi: more than one

Media (plural): means for conveying information

MULTIMEDIA CONCEPTS

What is Multimedia?

Mass media: Media in the press, Newspaper, Radio and TV

Transmission media: Media in communications: cables, satellite, network

Storage media: Media in computer storage: Floppy, CD, DVD, HD, USB

Interaction media: Media in HCI context: text, image, audio, video

MULTIMEDIA CONCEPTS

What is Multimedia?

Definition of Multimedia:

A computer- controlled technique for integrating text, graphics, drawings, still and moving images (Video), Animation, Audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.

MULTIMEDIA CONCEPTS

What is Multimedia?

Tony Feldman, Multimedia Consultant :

"Multimedia is the seamless integration of text, sound, images of all kinds and control software within a single digital information environment"

The Hutchinson Dictionary of Multimedia

Multimedia is computerized method of presenting information by combining audio and video components using text, sound and graphics (still, animated and video sequences)"

MULTIMEDIA CONCEPTS

Where can we find Multimedia?

Hospital: diagnostic data, medical presentation

Business; sales and marketing presentation, trade show presentation, advertisement

Education; courseware, simulation, Presentation, E-learning

Home; iTV, Internet sites, Satellite TV, mobile phones, ...

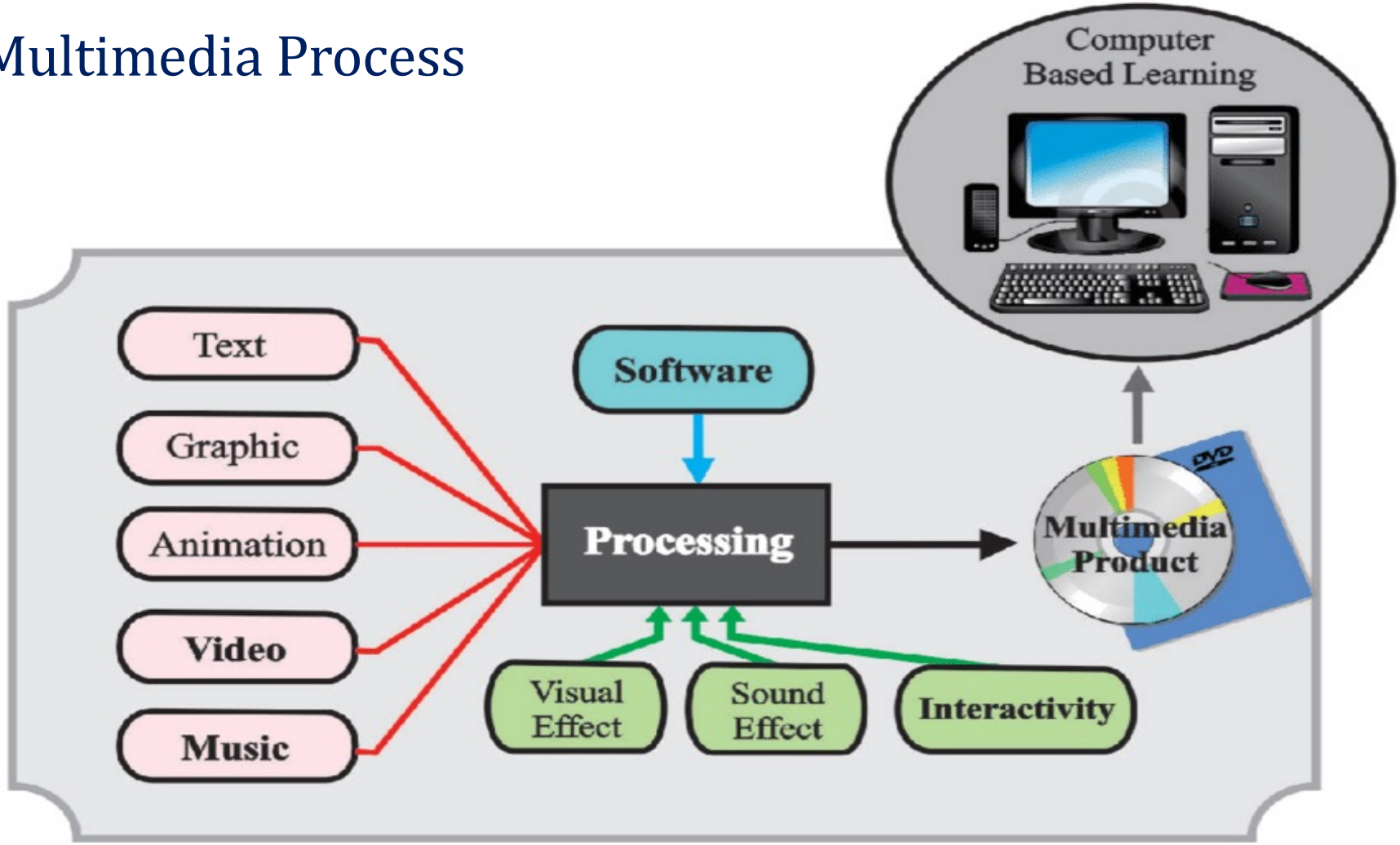
Public places; information Kiosk, Train stations, shopping centres

Entertainment: Games, Movies, etc

MULTIMEDIA CONCEPTS

MULTIMEDIA CONCEPTS

Multimedia Process



MULTIMEDIA CONCEPTS

Attributes of Multimedia?

Digitized:

- All media including audio/video are represented in digital format.
- Non digital information such as Analog signal is transformed into digital signal.

Attributes of Multimedia?

Distributed

- The information conveyed is remote, either pre-produced and stored or produced in real-time
- The information is distributed over networks or shareable media

MULTIMEDIA CONCEPTS

Attributes of Multimedia?

Computer controlled:

- Producing the content of the information e.g. by using the authoring tools, image editor, sound and video editor.
- Storing the information: providing large and shared capacity for multimedia information.
- Transmitting the information: through the network.
- Presenting the information to the end user: make direct use of computer peripheral such as display device (monitor) or sound generator (speaker).

Attributes of Multimedia?

Interactive

- Users interact to select the time at which the presentation starts, the order, the speed and the form of the presentation itself.
- Users can modify or enrich the content of the information.

MULTIMEDIA CONCEPTS

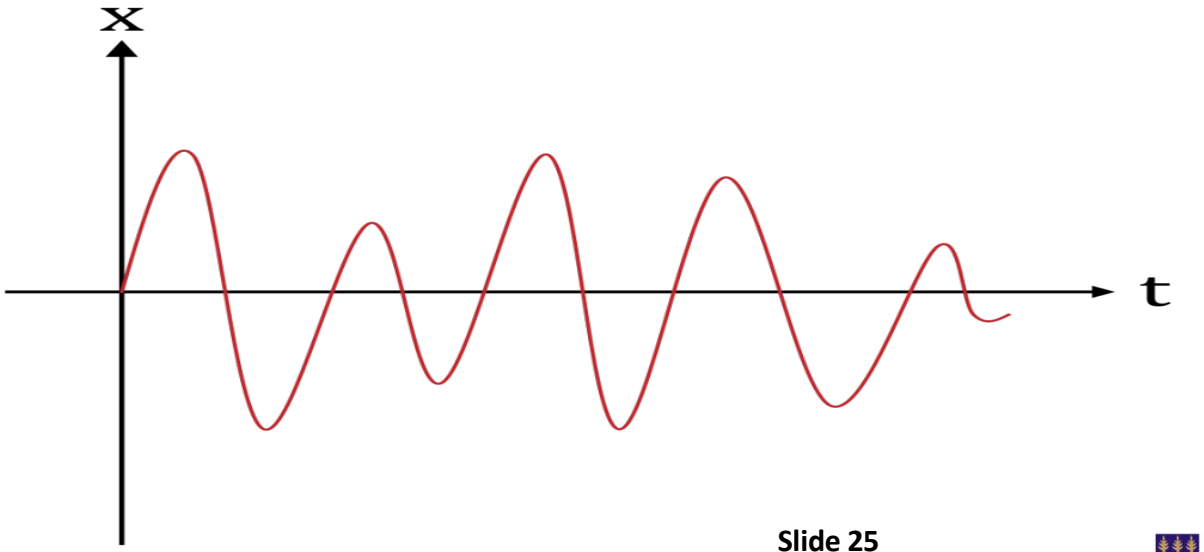
Attributes of Multimedia?

Integrated

- All Multimedia components (audio, video, text, graphics) used in the system are uniformly integrated.
- Every device such as microphone and camera are connected to and controlled by a single computer
- A single type of digital storage is used for all media type.
- Video sequence are shown on computer screen instead of TV monitor.

HISTORICAL DEVELOPMENT OF MULTIMEDIA

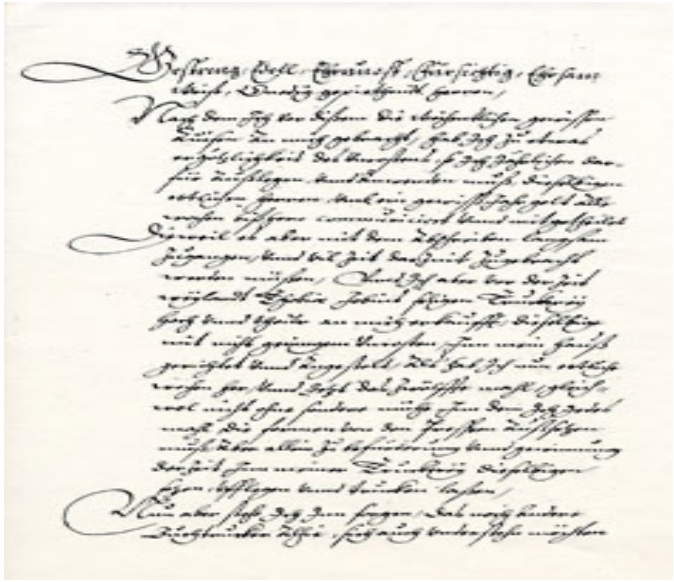
STILL / MOTION CAMERA

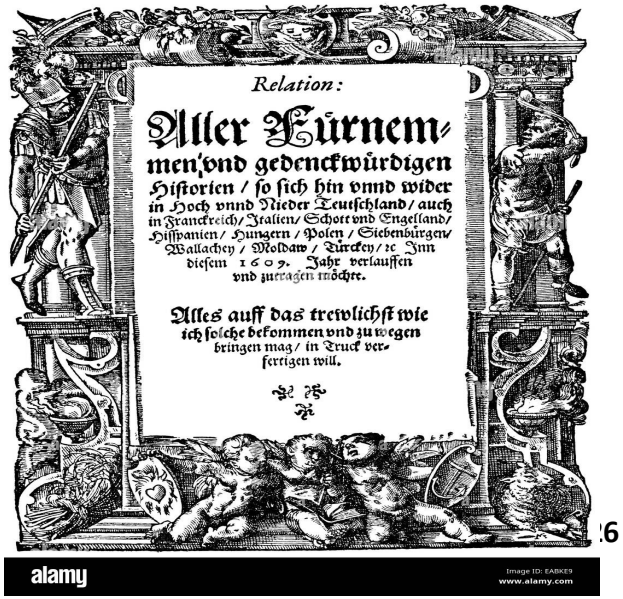


MULTIMEDIA CONCEPTS

Multimedia History?

- ✓ Newspaper: Perhaps the *first* mass communication medium, uses text, graphics, and images.
- ✓ The first weekly newspaper was published in Germany by Johann Carolus in 1604





MULTIMEDIA CONCEPTS

Multimedia History?

- ✓ Joseph Nicéphore Niépce captured the first natural image from his window in1826 using a sliding wooden box camera

Slide wooden Box Camera

MULTIMEDIA CONCEPTS

Multimedia History?

- ✓ Alphonse Giroux built the first commercial camera with a double-box design in 1839

Slide Wooden double-Box Camera

Daguerreotype camera

MULTIMEDIA CONCEPTS

Multimedia History?

George Eastman, invented a vintage dry plate camera in 1877

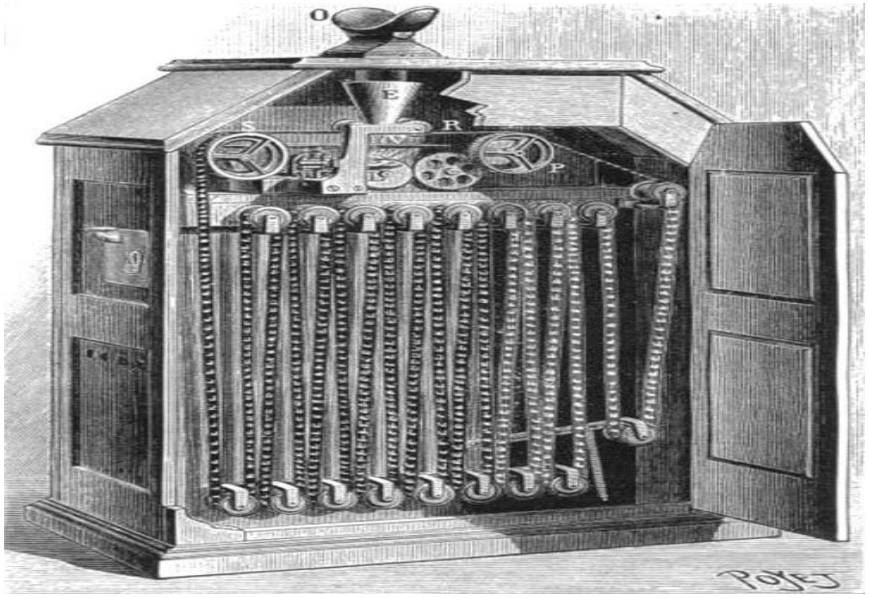
Vintage Dry-plate Camera

MULTIMEDIA CONCEPTS

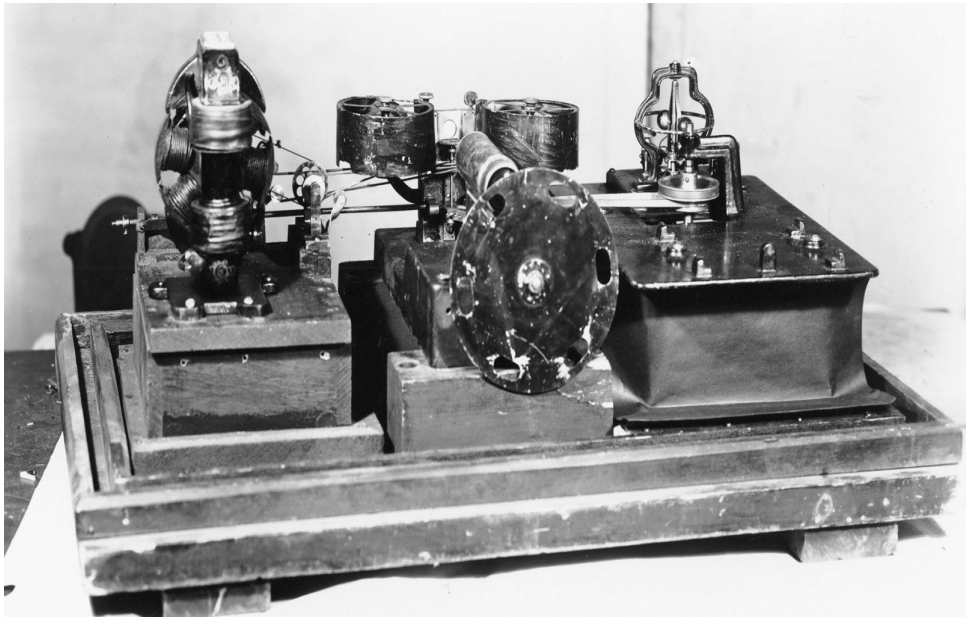
Multimedia History?

Thomas Edison in 1887 commissioned the invention of a motion picture camera, the Kinetograph (a motion picture camera) and the Kinetoscope (a peep-hole motion picture viewer)

kinetoscope

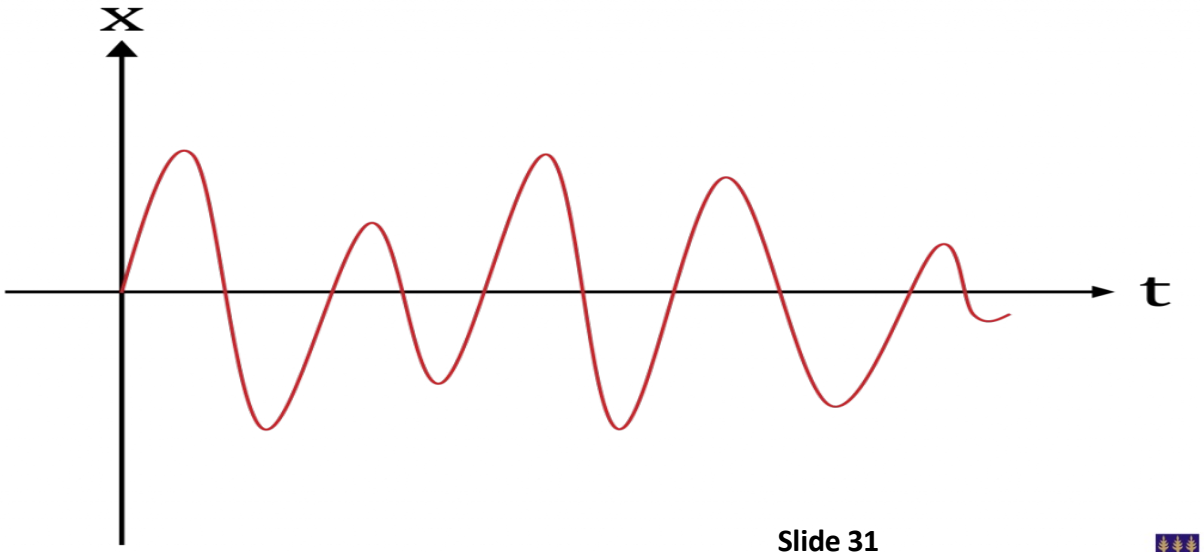


kinetograph



HISTORICAL DEVELOPMENT OF MULTIMEDIA

SOUND



MULTIMEDIA CONCEPTS

Multimedia History?

Thomas Alva Edison's phonograph, invented in 1877,was the first device that was able to record and reproduce sound. It originally recorded sound onto a tin-foil sheet phonograph cylinder.

Phonograph

MULTIMEDIA CONCEPTS

Multimedia History?

Alexander Graham Bell, a Scottish later improved phonograph to a new device called the graphophone in 1879. Most notable improvements include wax-coated cardboard cylinders instead of the tin-foil.

Graphophone

MULTIMEDIA CONCEPTS

Multimedia History?

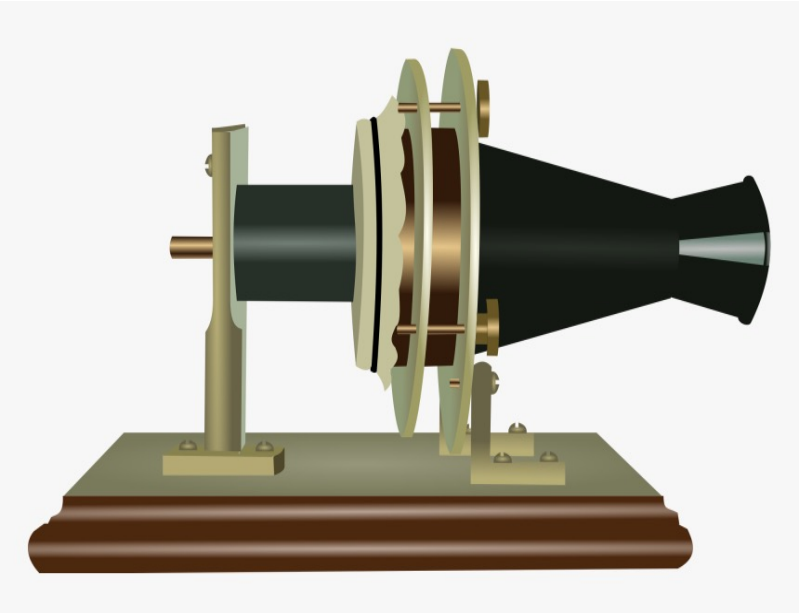
Alexander Graham Bell patented the first microphone in 1876.

He also invented the telephone and received a patent for it in 1876.

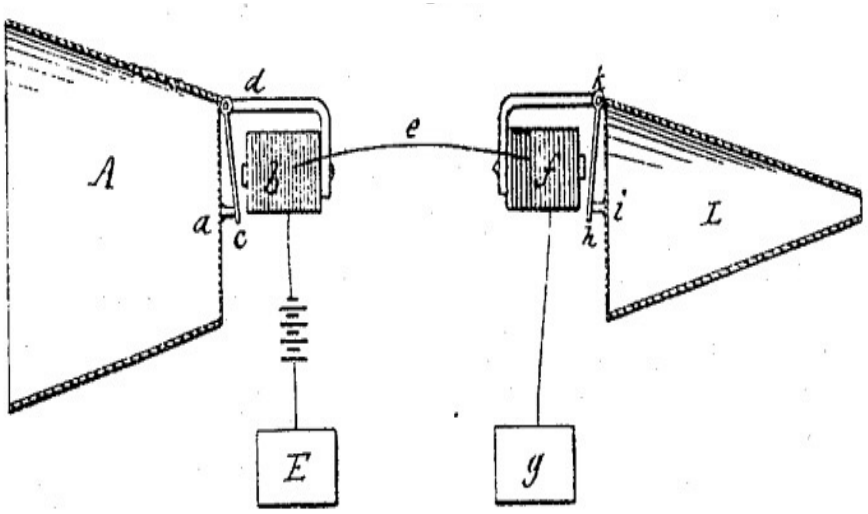
He co-founded the American Telephone and Telegraph Company (AT&T) in 1885

MULTIMEDIA CONCEPTS

Telephone



Microphone



MULTIMEDIA CONCEPTS

Multimedia History?

In 1887 the German, Emile Berliner transformed the phonograph cylinders to gramophone records.

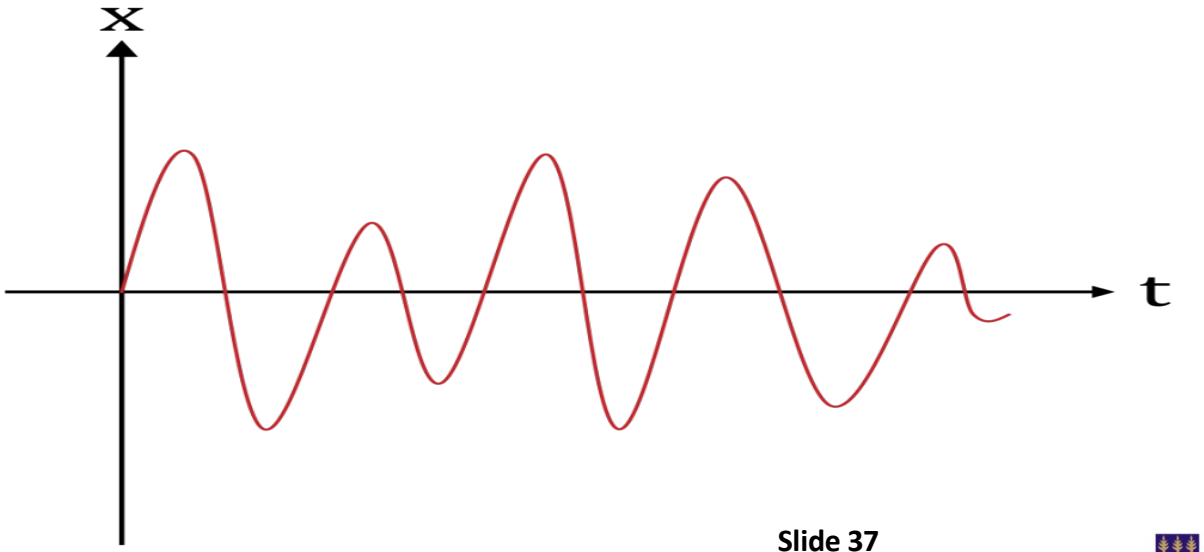
He also invented the Berliner microphone in 1876

Gramophone

Microphone

HISTORICAL DEVELOPMENT OF MULTIMEDIA

RADIO / TV



MULTIMEDIA CONCEPTS

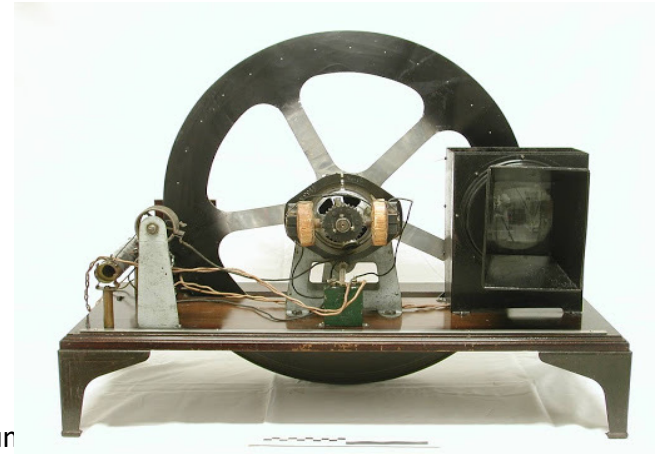
Multimedia History?

In 1895, Guglielmo Marconi conducted the first wireless radio transmission at Pontecchio, Italy, and a few years later (1901), he detected radio waves beamed across the Atlantic

MULTIMEDIA CONCEPTS

Multimedia History?

In 1884, Paul Gottlieb Nipkow, a 23-year-old university student in Germany, patented the first electromechanical television system which employed a spinning disk with a series of holes spiralling toward the centre

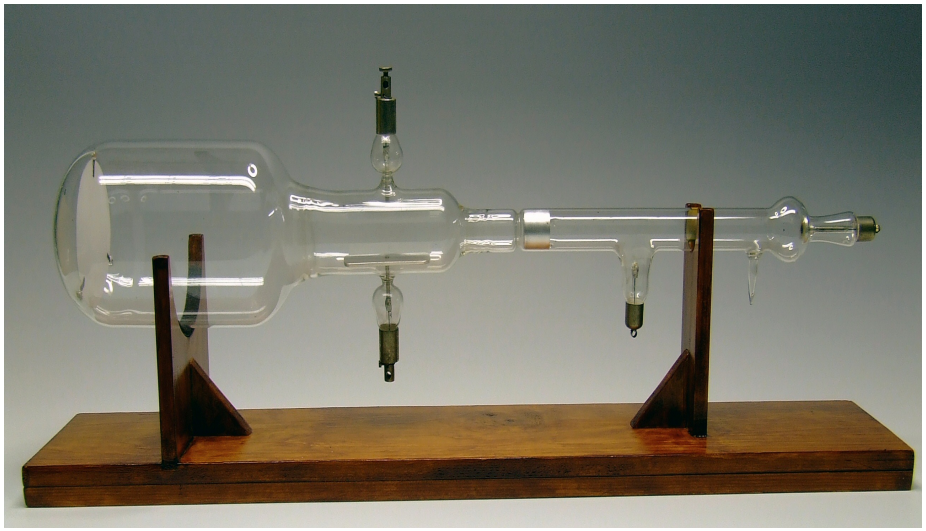


MULTIMEDIA CONCEPTS

Multimedia History?

The Cathode Ray Tube or Braun's Tube was invented by the German physicist **Karl Ferdinand Braun** in 1897

This was a great amplifier tube technology that completed Nipkow's design and made it practical



MULTIMEDIA CONCEPTS

Multimedia History?

Commercially available since the late 1920s, CRT-based TV established video as a commonly available medium and has since changed the world of mass communication.

MULTIMEDIA CONCEPTS

1930s

1940s

1950s

1960s

1970s

1980s

1990s

2000s

2010s

A

MULTIMEDIA CONCEPTS

MULTIMEDIA HISTORY?

THE DIGITAL ERA

MULTIMEDIA CONCEPTS

Multimedia History?

1967 Nicholas Negroponte formed the Architecture Machine Group at MIT.

1969 Nelson and van Dam at Brown University created an early hypertext editor called FRESS.

1976 The MIT Architecture Machine Group proposed a project entitled “Multiple Media.” This resulted in the Aspen Movie Map, the first videodisk, in 1978.

1982 The Compact Disc (CD) was made commercially available by Philips and Sony, which was soon becoming the standard and popular medium for digital audio data

MULTIMEDIA CONCEPTS

Multimedia History?

1985 Negroponte and Wiesner co-founded the MIT Media Lab, a leading research institution investigating digital video and multimedia.

1990 Kristina Hooper Woolsey headed the Apple Multimedia Lab, with a staff of 100. Education was a chief goal.

1991 MPEG-1was approved as an international standard for digital video. Its further development led to newer standards, MPEG-2, MPEG-4, and further MPEGs, in the 1990s.

MULTIMEDIA CONCEPTS

Multimedia History?

- *1992 JPEG* was accepted as the international standard for digital image compression, which remains widely used today
- *1992* The first audio multicast on the multicast backbone (MBone) was made.
- 1995 The JAVA language was created for platform-independent application development, which was widely used for developing multimedia applications.

MULTIMEDIA CONCEPTS

Multimedia History ?

1991 The introduction of PDAs in 1991 began a new period in the use of computers in general and multimedia in particular. This development continued in 1996 with the marketing of the first PDA with no keyboard.

1996 DVD video was introduced; high-quality, full-length movies were distributed on a single disk. The DVD format promised to transform the music, gaming, and computer industries.

1998 HandheldMP3audio players were introduced to the consumer market, initially with 32 MB of flash memory.

Forces driving Multimedia Evolution

Evolution of Communication and Data Networks:

Increasing availability of bandwidth on demand in the office, home, road.... Thanks to high-speed data modems, cable modems, hybrid fibre-coax systems, xDSL, wireless.

Forces driving Multimedia Evolution

Ubiquitous Access to Network.

Via Local Area Networks (LAN), wireline and wireless networks, Internet, world wide web, "anywhere, anytime".

MULTIMEDIA CONCEPTS

Forces driving Multimedia Evolution

Fast Processor and Large Capacity Storage Devices

Moore's law: computation and memory capacity of chips doubles every 18 months .

New Algorithms and Data structures.

Compression techniques, graphics, computer vision, speech understanding...

MULTIMEDIA CONCEPTS

Forces driving Multimedia Evolution

Availability of Smart terminals: these include digital phones, screen phones, multimedia PC's, web-TV, Personal Digital Assistants, etc., accessing and interacting the network with wired and wireless connections.

Techniques for compressing and coding the various media: models, algorithms, forms, standards, etc.

MULTIMEDIA CONCEPTS

Forces driving Multimedia Evolution

Indexing Techniques for organizing, storing and retrieving multimedia: These helps in searching and browsing individual multimedia documents and libraries.

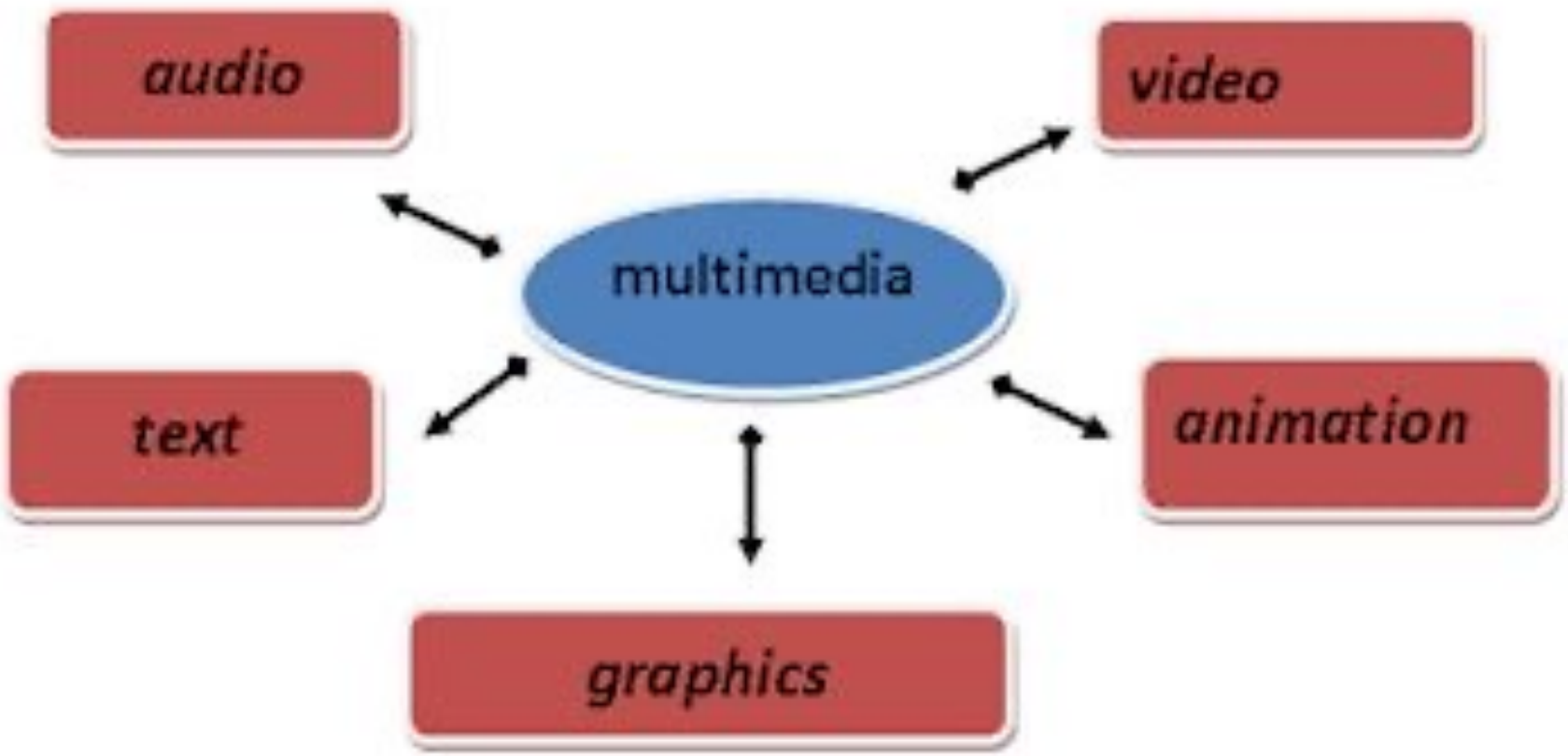
Techniques for accessing multimedia signals: These provides tools that match user to the machine: "natural" spoken language queries, media conversion tools

MULTIMEDIA CONCEPTS

Components / Elements of Multimedia

- Text
- Graphic
- Animation
- Video
- Audio

MULTIMEDIA CONCEPTS



MULTIMEDIA CONCEPTS

Components / Elements of Multimedia

Text

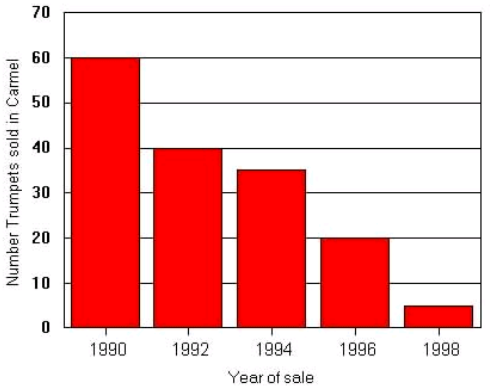
- Characters that are used to create words, sentences, and paragraphs
- All multimedia products contain some amount of text
- Text could be alphanumeric: alphabets, numbers and special characters
- E.g. ASCII/Unicode, HTML, Postscript, PDF

MULTIMEDIA CONCEPTS

Components / Elements of Multimedia

❑ Graphic

- A digital representation of non-text information, such as a drawing, chart, or photograph.



MULTIMEDIA CONCEPTS

Components / Elements of Multimedia

Graphic can be classified into;

Bitmaps Graphics: these are real images captured through digital devices such as camera. They are not editable and consumes large amount of memory

Vector Graphics- Vector graphics are drawn on the computer and only require a small amount of memory. These graphics are editable.

MULTIMEDIA CONCEPTS

Components / Elements of Multimedia

❑ Animation

- A process of making a static image look like it is moving.
- It involves Flipping through a series of still images.
- It is a series of graphics that create an illusion of motion.

MULTIMEDIA CONCEPTS

Components / Elements of Multimedia

❑ Video

- The term video refers to the moving picture, accompanied by sound such as a picture in television.
- photographic images that are played back at speeds of 15 to 30 frames a second and that provide the appearance of full motion.
- E.g., Movie

MULTIMEDIA CONCEPTS

Components / Elements of Multimedia

❑ Audio

- Audio may include speech, music, sound and its related effects. Audio could be in Analog or digital forms.
- Analog audio or sound refers to the original sound signal.
- Analog audio must be converted to digital form before computer can process and store them