Unit 8

Multimedia Application

- Media Preparation and Composition
- Media Integration and Communication
- Media Entertainment
- Telemedicine
- E-learning
- Digital Video Editing and Production Systems
- Video Conferencing
- Video-on-demand

Please also refer to the additional slides (telemedicine final.pptx) provided as separate file. Those slides are from someone who teaches multimedia at another campus.

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Introduction:

- The development in multimedia computing and communications have led to continuous development a myriad of applications.
- Existing applications have been enhanced(re-engineered) to support multimedia to make them more user-friendly.
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Multimedia development projects/programs

- Several programs for the development of multimedia applications have been established in the past.

In USA:

- HPCC (high performance computing and communication) program was established in 1980s for the development scalable, high-performance computers, advanced high-speed computer networks and advanced software.
- One of the HPCC component is IITA (Information Infrastructure Technology and Applications) program.
- IITA supports applications such as:
  - Tele-medicine: A person's medical records(x-ray etc) can be sent to a remote physician.
  - Remote education and training: the remote access to books, films, music, art work to teachers and students
  - Tele-operation: To improve design and manufacturing operations to produce safer and efficient cars, airplanes, homes etc. The operational tasks may be performed in distributed manner.
  - Information Access: Universal access to government data and information products by industry and public.

In Europe:

- ESPRIT (European Strategic Program for Research in Information Technology) is a well-known scientific program of the European Community.
- The primary goal of ESPRIT is to support development of technology similar to HPCC.
- RACE(research in advanced communication) is a small program focused in communication.
- The RACE projects cover applications such as:
  - Tele-interaction: Use of tele-services in information systems e.g. information kiosks and entertainment(telegames).
  - Tele-shopping: Convenient shopping, sales and advertisement remotely
  - Interactive TV: Use of thematic channels to create new custom programs(e.g. education and also support teleshopping.
  - Teleworking: Home offices, and collaboration using Video-conferencing.

Classification of multimedia applications

- There are many views on how multimedia applications should be classified.

View	Types of applications
Market-oriented and Pragmatic view	Kiosk applications
	Educational applications
	Corporate work applications
Communication-oriented view	Interactive applications
	Distribution-oriented applications
The “media food chain” view (based on type of support provided to the user)	media preparation application
	Media composition applications
	Media integration applications
	Media communication applications
	Media consumption applications
	Entertainment applications

1. Media preparation

- Media preparation is concerned with preparing media for different applications.
- Media preparation mainly requires hardware technology (sometimes, in combination with software technology).
- Depending on the media, different hardware applications are used.

i. **Audio support devices**: Hardwares for audio support include multiple-channel digital sound devices (woofer systems, stereo systems etc)

ii. **Video support devices**: Video cards and digitizers are hardware for high-quality picture presentation. Graphical displays provide high-quality for image/video/graphics applications. Videos mixing/merging can be done with video controller. Video mixing is required in television news, sports etc. For virtual reality applications several kinds of displays are used such as: Head-mounted displays, Surround displays, Digital holography.

iii. **Scanner Devices**: Image scanners support input and digitization of images and photographs. CCD (charge-coupled device) TV cameras, Photo (optical) scanners are some example devices.

iv. **Recognition devices**: Recognizers recognize different media. For example: character recognition. Character recognizers can recognize and transform handwritten text using pen-based applications. Other example of recognizers are: speech recognition to convert speech into text, image recognition to convert(describe) images to text etc..

v. **Tracking devices**: Trackers report information about position, orientation, etc of tracked objects. There are several technologies developed for tracking: Electromagnetic trackers, Ultrasonic trackers, optical tracking systems.

Other tracking systems are: finger-joint-angles tracking(sensory gloves) and eye tracking.

2. Media Composition

- Media composition involves editing single media.
- Many applications are available for media composition:
  - Text editors
  - Image/Graphics editors
  - Video/Animation editors
  - Sound editors

- **Text editors**: Text editors providing writing and modifying facilities to compose text in a document. Basic text editors deal with providing different fonts, text styles and text effects. However, modern text editors provide facilities for integrating other media such as graphics objects (e.g. Microsoft word)

- **Graphics/image editors**: Graphics editors use facilities at the user interface for editing graphics objects. Since graphics system stores object primitives and structural representation, the editing can be done in two levels: Structure-level editing and object-level editing. CorelDRAW is an example of graphics editor.

  Image editors are suitable for applications when we can not store the primitives. The images are stored in pixel representation. In such case we can edit the content of image by *read-pixel* and *write-pixel* operations. Image editors provide functionalities such as change in resolution, intensity, modification of RGV colors, etc. An example of graphics/image editor is Adobe Photoshop.

- **Video/Animation editors:** Animation editing is based on graphical editors for 2D or 3D graphical objects with additional component Time.

  Animation editors provide functionalities such as *cutting frames, adding new frames, individual frame editing* etc.

  Modern advanced animation tools have the capability to draw intermediate frames automatically while user draws only key frames.

  Autodesk Maya is an example of powerful animation application.

  Video editors are based on image editors for editing individual frames where temporal part is involved. Videos usually involve functionalities similar to animation editors.

  Modern video editors include functionalities for editing video, sound and music in integrated fashion.

- **Sound editors**: Sound tools support a number of operations that let user s access, modify and play sound data.

  The operations fall into three categories:

  - *Locating and storing sound* using analog-to-digital converter or creating sound algorithmically or reading sound data from file.
  - *Recording and playback*
  - *Editing* : copy/paste, cut, delete, insert or replace sampled sound data

  Digital music tools may include music editors (MIDI editors). Music editors include functionalities such as modification of loudness, amplitude, tone control, retrieval of note from a part and removal of group of notes.

3. Media Integration

- Media integration specifies relationships between various media elements to represent and manipulate a multimedia object (e.g. document).
- An integration tool should be platform-independent and format-independent.
- Media integration applications can be categorized into three categories:
  - **Multimedia editors**: multimedia editors support the ability to manipulate multimedia documents that include structured text, multi-font text, bitmap images, graphics, video, digitized voice and other modifiable objects.

    Each medium has its own structure, therefore a multimedia editor consists of a collection of powerful and complex editors for individual media provided in an integrated fashion.
  - **Hypermedia/Hypertext editors** : Hypermedia, an extension of the term hypertext, is a nonlinear medium of information that includes graphics, audio, video, plain text and hyperlinks. Hypermedia/hypertext documents consist of multimedia and non-linear links among the information. The documents are stored in multimedia databases in a structured representation (e.g HTML database for HTML documents). Hence editing means accessing document structures through links (associations) and editing objects according to their characteristics(text, graphics etc)

    Hypermedia/hypertext documents can be created and modified through hypermedia/hypertext tools such as: Adobe Flash, Adobe Director, Guide etc.
  - **Authoring Tools** :

Authoring Tools :

- An authoring system is a set of software tools for creating multimedia applications embedded in an authoring environment. A person who creates applications for multimedia integration (e.g. presentation) is called an author. The process is called authoring.

- The tools which provide the capability for creating a complete multimedia presentation, including interactive user control, are called authoring tools/programs.

  Some of the examples are: Macromedia Flash, Macromedia Director, Quest etc.

4. Media Communication

- Media communication denotes applications which exchange different media over network via tele-services (e.g video conferencing, mailing etc) to multimedia application end users.

Advantages of tele-services

- Users can interact closely despite being located in different places.
- Users can operate on remote data and resources

Applications of Tele-services

- Tele-services are used in many ways.
- One group of applications that use these services are the tele-working services. People can stay at their work or home and connect with other people for different purposes.
- Teleworking includes tele-activities such as follows:

i. Remote education

ii. Tele-office (Office in the home)

iii. Tele-collaboration

iv. Tele-medicine

v. Video conferencing

i. Remote education

- Remote education or remote learning is where the student and the educator, or information source, are not physically present in a traditional classroom environment.
- There can be two scenarios for remote education:
  - *All the students in same location (classroom) and the teacher is remotely located*: There is a large screen in the classroom where the students can see the teacher delivering instructions/lectures. the screen is also called video wall. The participants can communicate interactively. Modern applications such as zoom are popular examples.
  - *Individual students and the teacher are located in different locations:* Each participant is at different location and have own computer (or smartphone). The participants can interactively participate in the class. Zoom and microsoft's Team are popular applications for such individual tutoring.

Today we have sophisticated remote education applications with following features:

- ✓ Teacher and students can participate interactively with good audio/video quality.
- ✓ Class notes and related study materials can be shared
- ✓ Assignments can be provided and received with predefined deadline.
- ✓ Exams can be conducted.

Today, since bandwidth is no longer a problem, remote education applications are particularly becoming popular. Most universities in the world provide fully or partially online courses for those who are unable to attend on-campus classes. There are even universities entirely providing distance learning.

Benefits of Remote Learning applications

- ✓ The remote-education applications provide virtually all facilities those in traditional classroom.
- ✓ Remote learning provides access to education for those who otherwise may have no other opportunities.
- ✓ Remote learning allows students to engage with their coursework at a more personalized pace.
- ✓ Now it has become a common trend to use online education applications in adverse situations such as in case of contagious disease outbreak.

Limitations and Drawback of Remote Learning

- ✓ A good educations environment requires high network bandwidth and reliable connection.
- ✓ Many remote-education applications are still not matured enough and all of them are very complex systems. Hence, remote learning is susceptible to many technological difficulties and disruptions, and they can be extremely frustrating. We've all experienced those moments of utter frustration when technology simply does not work during moments when it must.

ii. Tele-office (Office in the home)

- Currently employees can work at home and still access various information sources and communicate with their colleagues , management and others via a high-bandwidth communication network.
- A home office application consist of audio/visual interaction service, data sharing service etc.

iii. Tele-collaboration

- Tele-collaboration has become an important part of our working environment .
- Simply speaking, tele-collaboration is the collaboration by remote participants by means of computer networks to perform a task or to solve a problem together.
- Collaborative computing involves many disciplines: multimedia, distributed systems and networking.

- To make tele-collaboration successful, the application creates a media space (a collaborative work environment).
- The collaborative work environment consists of –
  - High-bandwidth network supporting audio/video and other data.
  - Camera, microphone, and other computing devices.
  - Conversational service supporting one-to-one, many-to-one and many-to-many conversations.
  - Shared applications (white board) and recording and retrieving video records.

iv. Tele-medicine

- Tele-medicine services address medical help for people who cannot leave their home.
- Over the communication network, people can consult their doctors(tele-diagnosis), and get medical information and other administrative health information.

Tele-medicine involves following health-care related services:

- ***Tele-diagnosis*** is the process of consulting doctor in order to identify the cause of health problem. It uses a audio/visual communication service.
- ***Information retrieval service***: Access to medical information can be achieved through retrieval service.
- ***Tele-surgery***: this is the process of performing surgical operation at local hospitals by consulting remote specialist. Tele-surgery is used in situations when there is no specialist available nearby critical and difficult operations.

Tele-surgery is achieved by using remote camera control with conferencing capabilities.

Todays advanced multimedia systems and high-bandwidth networks allows direct audio and video transmission of live operation. In this way, a less experienced medial person can perform surgery by consulting live with remote specialist.

- ***Home monitoring***: (care at home). This involves care services at the home for the patient (e. g. for elderly patients, diabetics etc.)
- ***Telemonitoring***: Supervision of a patient and his data at distance, who is not in the hospital and/or clinic (e. g. diabetes patients, patients with heart insufficiencies)

- Many health institutions provide tele-medicine services using advanced multimedia tools such as online patient portals, patient management system, and audio/visual tool (camera, microphones etc)

v. Video conferencing

5. Media consumption applications

- Media consumption is the act of viewing, listening or feeling multimedia information.
- Viewing and listening are the most common ways users consume media.
- Feeling multimedia information can be experienced in motion-based systems (e.g. through virtual reality).

Requirements of media consumption application:

i. Simplicity of presentation is the major requirement

ii. Familiar UI must be created

iii. Should be easier to navigate through the application.

Some media consumption applications:

Books, research papers and Newspapers

Kiosks

Tele-shopping

Books, research papers and Newspapers

- In today's world, traditional methods (paper-printed) for delivering information is becoming obsolete. Now we have electronic forms (with nice multimedia) of books, research papers and newspapers distributed over networks.
- Books, research paper and newspapers can be interactive multimedia documents. Instead of broadcasting the same newspaper to all readers, the user access the electronic versions of newspapers, magazines, books etc according to need.

Kiosks

- Recent technology advances have made possible the high-quality delivery of video and audio integrated into the desktop computing environment. This capability has created an opportunity to create public information services known as multimedia kiosk systems.
- A multimedia kiosk is any type of large computer terminal, most often located in a public place, which the general public may use for various purposes. For example, an ATM machine is a type of multimedia kiosk.
- Kiosk systems are often located in public areas, accessible to visitors or customers.
- Kiosks are controlled by a computer that allows the user to interactively control information or service the user wants to obtain. Since kiosk customers are often unskilled, the user interace must be simple and easy to handle.

Types of Kiosks

Employment Kiosks: In addition to kiosks that sell retail products or services, some companies set up employment kiosks where job seekers can apply for work. The kiosk may include a computer station at which the applicant can use a keyboard or touchscreen to input their employment history, education, and personal data. Information collected at the kiosk is frequently available to the hiring manager almost immediately.

Food Service Kiosks: In an effort to streamline the process of taking food orders, some restaurants install self-service kiosks. Customers can follow interactive prompts to select their meal and customize their order.

Healthcare Kiosks: The healthcare industry is also starting to implement kiosks as a method for accepting bill payments, checking in patients for appointments, and patient record keeping. At some kiosks, patients can even take their own blood pressure or perform other non-invasive tests and then relay the results to their doctors. In some cases, medical kiosks also offer educational videos about medical conditions and their treatments.

Tele-shopping

- In simple words, the purchase of goods by telephone or via the internet is called tele-shopping.
- Multimedia tele-shopping enables users to shop from home.
- Example of tele-shopping applications are: home ordering/shopping of goods, ticket reservation (theater, cinema, concerts, shows, travels, etc).
- The service allows user to search for different products from the catalogue. The products may be presented with a combination of video sound and text.
- Traditionally, tele-shopping was done via telephone.
- Now due to availability of high-bandwidth network and powerful multimedia enabled computers, tele-shopping is done via Internet.

5. Media Entertainment

- Some applications that use multimedia for entertainment are:
  - **Virtual reality**
  - **Interactive Video/Audio**
  - **Video on demand**
  - **Games**

Virtual Reality: VR is the computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person

Unlike traditional user interfaces, VR places the user inside an experience. Instead of viewing a screen in front of them, users are immersed and able to interact with 3D worlds using special devices, such as a helmet with a screen inside (Head-mounted display), gloves fitted with sensors.

VR provides user a sense of presence inside the system (visual, auditory or tactile). It also includes haptic displays(devices with force feedback).

Now, VR is being used in many areas such as education and training, engineering, and entertainment(games, cinema, music).

In games: Early commercial virtual reality headsets were released for gaming during the early-mid 1990s. These included the Virtual Boy, iGlasses, Cybermaxx and VFX1 Headgear. Modern commercial headsets for VR gaming include the Oculus Rift, PlayStation VR etc. The Samsung Gear VR is an example of a phone-based device.

Other modern examples of VR for gaming include the Wii Remote, the Kinect, and the PlayStation Move/PlayStation Eye, all of which track and send player motions to the game. Many devices complement VR with controllers or haptic feedback.

In cinema: Films produced for VR permit the audience to view scenes in 360 degrees. This can involve the use of VR cameras to produce interactive films and series.

In music: VR can allow individuals to virtually attend concerts. The viewer feels himself/herself actually present in the concert. Virtual reality can be used for other forms of music, such as music videos and music visualization or visual music applications.

Interactive Video/Audio

- Interactive video (IV) is a digital multimedia presentation that can take user input to perform some action.
- Traditional video, or linear video, we have options to "play", pause, rewind, fast forward and restart the video during the experience. Aside from those limited functions, there isn't much we can do to interact with a linear video.
- An interactive video gives the viewer the ability to interact with the video content itself through a variety of tools. Users can click, drag, scroll, hover, gesture and complete other digital actions to interact with the video's content, similar to the way they'd interact with web content.
- At its simplest, an interactive video might connect the user to an external website. A shoppable video, for example, might demonstrate a product and include hot links to take users to the vendor's website to learn more or make a purchase.

- Interactive video has many possible uses. E.g., interactive video for distance education allows students to select among multiple channels for further information at points throughout the presentation. It could also include a quiz after a lecture segment that evaluates responses and gives students immediate feedback.
- Now, interactive videos have become a popular tool for advertising and marketing.
- Interactive television and Video-on-demand are also areas of interactive video.

Interactive audio:

- Similar to interactive video, Interactive audio is a technological approach to sound whereby allow audio, placed in a given application, is designed to react to user input and or changes in the application environment.

- Today we have audio-on-demand where the audio server stores music libraries and listeners are able to retrieve their requested song.
- Another interactive audio application is the Intelligent vehicle highway system where a car can instruct driver through correct route with timely voice instruction according to the car's location and movement.

  e.g. when a care reaches crossway, the car instructs "turn right".

Games

- Computer game is an excellent example of multimedia application.
- Modern computer game is an audiovisual engine capable of keeping an internal model of some dynamic system.
- Games are based on interactivity between the user and the computer.
- There are different **categories of games**

Based on location (local vs tele-game): Local games are stored in local computer whereas in tele-games the game is stored in remote computer server. The players play the game from their PC by connecting to the server. Tele-game is usually multiplayer 3D. PUBG is an example of tele-game. Another forms of tele-games is where the games is not on central server. The game is installed on individual machines and users play in a peer-to-peer manner over a network.

Based on players: (single vs multiplayer): In a single-player game, there is only one player who usually begins from a starting point/event and goes through obstacles/difficulties to reach a destination point/event

In a multiplayer game, multiple players play either in coordination (all players trying to achieve a common goal by fighting against game-generated enemy or overcoming the obstacles) or adversarily (each player trying to win by fighting with other player or by other means)

Based on environment: (interactive with audio/visual components vs interactive with advanced technology components such as VR): Simple games usually include a storyline with normal audio/visual components. It is like a video with user interaction added. That is why they are called video games. In a VR-enabled game, the user gets an illusion of actually being in the game. The user wears a helmet with HMD(head-mount display)(and headphones, so that the user will be surrounded by a synthetically generated environment. The user might also be wearing data glove with motion sensors or using haptic displays.

Video on demand

End of unit 8

Thank you!