جمهورية العراق

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education & Scientific Research

Al-Mustaqbal University College

Department of Computer Techniques Engineering

Multimedia Computing

Lecturer : Ali Al-Safi

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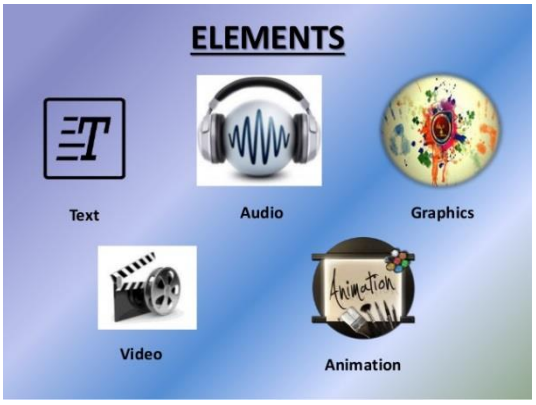
7. Multimedia Data Basics

Multimedia systems/applications have to deal with the

- Generation of data
- Manipulation of data
- Storage of data
- Presentation of data
- Communication of information/data

The data may be in a variety of formats:

Text Graphics Images
Audio Video



Static or Discrete Media: Some media is time independent: Normal data, text, single images and graphics are examples.

Continuous Media: Time dependent Media: Video, animation and audio are examples.

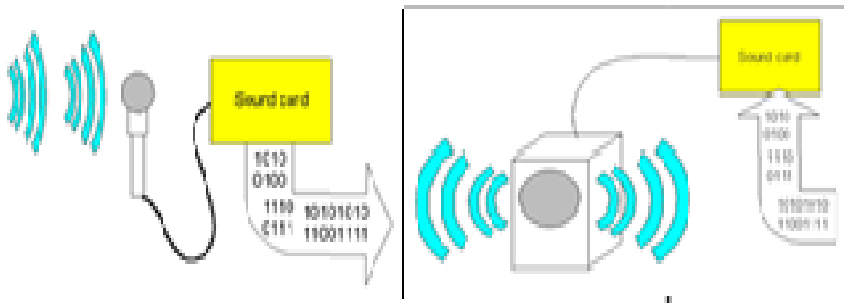
Analog and Digital Signal Conversion

The world we sense is full of analog signals:

Electrical sensors convert the medium they sense into electrical signals

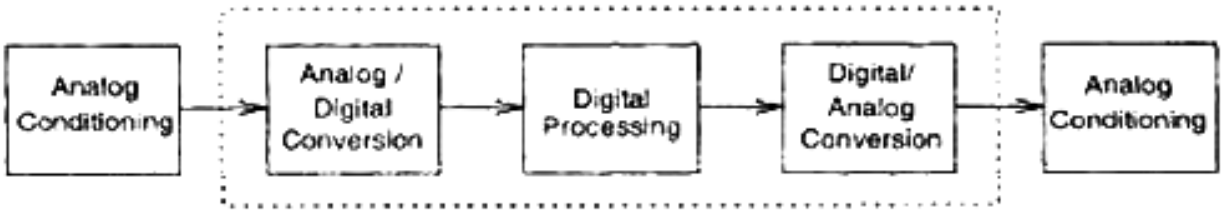
- E.g. transducers, thermocouples: temperature sensor, microphones: acoustic sensor
- Cameras (Still and Video): light sensor. (usually) continuous Analog signals (e.g. Sound and Light)

- Analog: continuous signals must be converted or digitised for computer processing.
- Digital: discrete digital signals that computer can readily deal with.
- Special hardware devices: Analog-to-Digital Playback {a converse operation to Analog-to-Digital converters. E.g. Audio: Take analog signals from analog sensor (e.g. microphone) and digitally sample data



Analog-to-Digital-to-Analog Pipeline

• Begins at the conversion from the analog input and ends at the conversion from the output of the processing system to the analog output as shown:



- Anti-aliasing filters (major part of Analog Conditioning) are needed at the input to remove frequencies above the sampling limit that would result in aliasing. The anti-aliasing filter at the output removes the aliases that result from the sampling.
- After the anti-aliasing filter, the analog/digital converter (ADC) quantises the continuous input into discrete levels.

- After digital processing, the output of the system is given to a digital/analog converter (DAC) which converts the discrete levels into continuous voltages or currents.
- This output must also be filtered with a low pass filter to remove the aliases from the sampling. Subsequent processing can include further filtering, mixing, or other operations.

Multimedia Data: Input and Format

How to capture and store each Media format?

- Note that text and graphics (and some images) are mainly generated directly by computer/device (e.g. drawing/painting programs) and do not require digitising: They are generated directly in some (usually binary) format.
- Printed text and some handwritten text can be scanned via Optical Character Recognition.
- Handwritten text could also be digitised by electronic pen sensing.
- Printed imagery/graphics can be scanned directly to image formats.

Text and Static Data

- Source: keyboard, speech input, optical character recognition, data stored on disk.
- Stored and input character by character:
- Storage: 1 byte per character (text or format character), e.g. ASCII; more bytes for Unicode. For other forms of data (e.g. Spread sheet les). May store as text (with formatting, e.g. CSV {Comma-Separated Values) or may use binary encoding.
- Formatted Text: Raw text or formatted text e.g HTML, Rich Text Format (RTF), Word or a program language source (Java, Python, MATLAB etc.)

- Data Not temporal | BUT may have natural implied sequence e.g. HTML format sequence, Sequence of Java program statements.
- Size Not signi cant w.r.t. other Multimedia data formats. Compression: convenient to bundle les for archiving and transmission of larger les. E.g. Zip, RAR, 7-zip. General purpose compression programs may not work well for other media types: audio, image, video etc.

Graphics

- Format: constructed by the composition of primitive objects such as lines, polygons, circles, curves and arcs.
- Input: Graphics are usually generated by a graphics editor program (e.g. illustrator, Freehand) or automatically by a program (e.g. Postscript).
- Graphics input devices: keyboard (for text and cursor control), mouse, trackball or graphics tablet.
- Graphics are usually selectable and editable or revisable (unlike images).
- Graphics les usually store the primitive assembly.
- Do not take up a very high storage overhead.
- Graphics standards: Open Graphics Library, a standard specification defining a cross-language, cross-platform API for writing applications that produce 2D/3D graphics.
- Animation: can be generated via a sequence of slightly changed graphics.
- 2D animation: e.g. Flash | Key frame interpolation: tweening: motion & shape.

  3D animation: e.g. Maya.
- Change of shape/texture/position, lighting, camera Graphics animation is compact
- Suitable for network transmission (e.g. Flash).

Images

- Still pictures which (uncompressed) are represented as a bitmap (a grid of pixels).
- Input: scanned for photographs or pictures using a digital scanner or from a digital camera.
- Input: May also be generated by programs similar to graphics or animation programs.
- Analog sources will require digitising.
- Stored at 1 bit per pixel (Black and White), 8 Bits per pixel (Grey Scale, Colour Map) or 24 Bits per pixel (True Colour).
- Size: a 512x512 Grey scale image takes up 1/4 MB, a 512x512 24 bit image takes 3/4 MB with no compression.
- This overhead soon increases with image size | modern high digital camera 10+ Megapixels 29MB uncompressed.
- Compression is commonly applied.
- Can usually only edit individual or groups of pixels in an image editing application, e.g. photoshop.

Audio

- Audio signals are continuous analog signals.
- Input: microphones and then digitised and stored.
- CD Quality Audio requires 16-bit sampling at 44.1 KHz: Even higher audiophile rates (e.g. 24-bit, 96 KHz).
- 1 Minute of Mono CD quality (uncompressed) audio = 5 MB. Stereo CD quality (uncompressed) audio = 10 MB.
- Usually compressed (E.g. MP3, AAC, Flac, Ogg Vorbis).

Video

- Input: Analog Video is usually captured by a video camera and then digitised, although digital video cameras now essentially perform both tasks.
- There are a variety of video (analog and digital) formats.

Raw video can be regarded as being a series of single images. There are typically 25, 30 or 50 frames per second.