4.3 MULTIMEDIA INPUT/OUTPUT TECHNOLOGIES

Multimedia Input and Output Devices

Wide ranges of Input and output devices are available for multimedia.

Image Scanners: Image scanners are the scanners by which documents or a manufactured part are scanned.

The scanner acts as the camera eye and take a photograph of the document, creating an unaltered electronic pixel representation of the original.

Sound and Voice: When voice or music is captured by a microphone, it generates an electrical signal. This electrical signal has analog sinusoidal waveforms. To digitize, this signal is converted into digital voice using an analog-to-digital converter.

Full-Motion Video: It is the most important and most complex component of Multimedia System. Video Cameras are the primary source of input for full-motion video.

. **Pen Driver**: It is a pen device driver that interacts with the digitizer to receive all digitized information about the pen location and builds pen packets for the recognition context manager. Recognition context manager: It is the main part of the pen system. It is responsible for co-ordinating windows pen applications with the pen. It works with Recognizer, dictionary, and display driver to recognize and display pen drawn objects.

Recognizor: It recognizes hand written characters and converts them to ASCII.

Dictionary: A dictionary is a dynamic link library (DLL); The windows form pen computing system uses this dictionary to validate the recognition results.

Display Driver: It interacts with the graphics device interface' and display hardware. When a user starts writing or drawing, the display driver paints the ink trace on the screen.

Video and Image Display Systems Display System Technologies

There are variety of display system technologies employed for decoding compressed data for displaying. Mixing and scaling technology: For VGA screen, these technologies are used.

VGA mixing: Images from multiple sources are mixed in the image acquisition memory.

VGA mixing with scaling: Scalar ICs are used to sizing and positioning of images in predefined windows.

Dual buffered VGA mixing/Scaling: If we provide dual buffering, the original image is prevented from loss. In this technology, a separate buffer is used to maintain the original image.

Visual Display Technology Standards

MDA: Monochrome Display Adapter.

It was introduced by IBM . displays 80 x 25 rows and columns .

:. It could not display bitmap graphics .

:. It was introduced in 1981.

CGA: Color Graphics Adapter .

:. It was introduced in 1981.

.:. It was designed to display both text and bitmap graphicsi

it supported RGB color display,

.:. It could display text at a resolution of 640 x 200 pixels .

:. It displays both 40 x 25 and 80 x 25 row!' and columns of text characters.

MGA: Monochrome Gr.aphics Adapter .

:. It was introduced in 1982 .

:. It could display both text and graphics .

:. It could display at a resolution 720 x 350 for text and

720 x 338 for Graphics . MDA is compatible mode for this standard.

EGA: Enhanced Graphics Adapter .

:. It was introduced in 1984 .

:. It emulated both *MDt.* and CGA standards .

:. It allowed the display of both text and graphics in 16 colors at a resolution of 640 x· 350 pixels.

PGA: Professional Graphics Adapter.

.:. It was introduced in 1985 .

:. It could display bit map graphics at 640 x 480 resolution and 256 colors .

• :. Compatible mode of this standard is CGA.

VGA: Video Graphics Array . :. It was introduced by IBM in 1988 .

:. It offers CGA and EGA compatibility .

:. It display both text and graphics .

:. It generates analog RGB signals to display 256 colors .

:. It remains the basic standard for most video display systems.

SVGA: Super Video Graphics Adapter. It is developed by VESA (Video Electronics Standard Association) . It's goal is to display with higher resolution than the VGA with higher refresh rates with minimize flicker.

XGA: Extended Graphics Array

It is developed by IBM . It offers VGA compatible mode . Resolution of 1024 x 768 pixels in 256 colors is offered by it. XGA utilizes an interlace scheme for refresh rates.

Flat Panel Display system

Flat panel displays use a fluorescent tube for backlighting to give the display a sufficient level of brightness. The four basic technologies used for flat panel display are:

1. Passive-matrix monochrome
2. Active-matrix monochrome
3. Passive-matrix color
4. Active-matrix color.

LCD (Liquid Crystal Display)

Construction: Two glass plates each containing a light polarizer at right angles to the other plate, sandwich the nematic (thread like) liquid crystal material.

Liquid crystal is the compounds having a crystalline arrangement of molecules. But it flow like a liquId. Nematic liquid crystal compounds are tend to keep the long axes of rod-shaped molecules aligned. Rows of horizontal transparent conductors are built into one glass plate, and columns of vertical conductors are put into the other plate. The intersection of two conductors defines a pixel position.

Passive Matrix LCD

Working: Normally, the molecules are aligned in the 'ON' state.

Polarized light passing through the materials is twisted so that it will pass through the opposite polarizer. The light is then reflected back to the viewer. To turn off the pixel, we have to apply a voltage to the two intersecting conductors to align molecules so that the light is not twisted.

ACTIVE Matrix LCD

In this device, a transistor is placed at each pixel position, using thin-film transisor technology.

The transistors are used to control the voltage at pixel locations and to prevent charge from gradually leaking out of the liquid crystal cells.

PRINT OUTPUT TECHNOLOGIES

There are various printing technologies available namely Dot matrix, inkjet, laser print server and ink jet color. But, laser printing technology is the most common for multimedia systems.

To explain this technology, let us take Hewlett Packard Laser jet-III laser printer as an example. The basic components of the laser printer are

.:. Paper feed mechanism **.:.** Paper guide **.:.** Laser assembly **.:.** Fuser **.:.** Toner cartridge.

Working: The paper feed mechanism moves the paper from a paper tray through the paper path in the printer. The paper passes over a set of corona wires that induce a change in the paper .

• The charged paper passes over a drum coated with fine-grain carbon (toner), and the toner attaches itself to the paper as a thin film of carbon .The paper is then struck by a scanning laser beam that follows the pattern of the text on graphics to be printed . The carbon particles attach themselves to the pixels traced by the laser beam . The fuser assembly then binds the carbon particles to the paper.

Role of Software in the printing mechanism:

The software package sends information to the printer to select and control printing features . Printer drivers (files) are controlling the actual operation of the printer and allow the application software to access the features ofthe printer.

IMAGE SCANNERS

In a document imaging system, documents are scanned using a scanner. \The document being scanned is placed on the scanner bed or fed into the sheet feeder of the scanner .The scanner acts as the camera eye and takes a photograph of the document, creating an image of the original. The pixel representation (image) is recreated by the display software to render the image of the original document on screen or to print a copy

of it.

Types of Scanners

A and B size Scanners, large form factor scanners, flat bed scanners, Rotory drum scanners and hand held scanners are the examples of scanners.

Charge-Coupled Devices All scanners use charge-coupled devices as their photosensors. CCDs consists of cells arranged in a fixed array on a small square or rectangular solid state surface. Light source moves across a document. The intensity of the light reflected by the mirror charges those cells. The amount of charge is depending upon intensity of the reflected light, which depends on the pixel shade in the document.

Image Enhancement Techniques

HalfTones In a half-tone process, patterns of dots used to build .scanned or printed image create the illusion of continuous shades of gray or continuous shades of color. Hence only limited number of shades are created. This process is implemented in news paper printers.

But in black and white photograph or color photograph, almost infinite levels of tones are used.

Dithering

Dithering is a process in which group of pixels in different patterns are used to approximate halftone patterns by the scanners. It is used in scanning original black and white photographs.

Image enhancement techniques includes controls of brightness, deskew (Automatically corrects page alignment), contrast, sharpening, emphasis and cleaning up blacknoise dots by software.

Image Manipulation

It includes scaling, cropping and rotation.

Scaling: Scaling can be up or down, the scaling software is available to reduce or enlarge. This software uses algorithms.

Cropping: To remove some parts of the image and to put the rest of the image as the subset of the old image.

Rotation: Image could be rotated at any degree for displaying it in different angles.

VOICE Recognition System

Voice Recognition Systems can be classified into three types.

1.Isolated-word Speech Recognition.

2.Connected-word Speech Recognition.

3.Continuous Speech Recognition.

1. **Isolated-word Speech Recognition.**

It provides recognition of a single word at a time. The user must separate every word by a pause. The pause marks the end of one word and the beginning of the next word.

Stage 1: Normalization

The recognizer's first task is to carry out amplitude and noise normalization to minimize the variation in speech due to ambient noise, the speaker's voice, the speaker's distance from and position relative to the microphone, and the speaker's breath noise.

Stage2: Parametric Analysis

It is a preprocessing stage that extracts relevent time-varying sequences of speech parameters. This stage serves two purposes: (i) It extracts time-varying speech parameters. (ii) It reduces the amount of data of extracting the relevant speech parameters.

Training mode In training mode of the recognizer, the new frames are added to the reference list. **Recognizer mode**If the recognizer is in Recognizer mode, then dynamic time warping is applied to the unknown patterns to average out the phoneme (smallest distinguishable sound, and spoken words are constructed by concatenatic basic phonemes) time duration. The unknown pattern is then compared with the reference patterns.

A speaker independent isolated word recognizer can be achieved by groupi.ng a large number of samples corresponding to a word into a single cluster.

2Connected-Word Speech Recognition Connected-word speech consists of spoken phrase consisting of a sequence of words. It may not contain long pauses between words.

The method using Word Spotting technique

It Recognizes words in a connected-word phrase. In this technique, Recognition is carried out by compensating for rate of speech variations by the process called dynamic time warping (this process is used to expand or compress the time duration of the word), and sliding the adjusted connected-word phrase representation in time past a stored word template for a likely match.

Continuous Speech Recognition

This sytem can be divided into three sections:

(i) A section consisting of digitization, amplitude normalization, time nonnalization and parametric representation.

(ii) Second section consisting of segmentation and labeling of the speech segment into a symbolic string based on a knowledgebased or rule-based systems.

(iii) The final section is to match speech segments to recognize word sequences.

Voice Recognition performance

It is categorized into two measures: Voice recognition performance and system performance. The

following four measures are used to determine voice recognition performance.

1. **Voice Recognition Accuracy**

$$\text{Voice Recognition Accuracy} = \frac{\text{Number of correctly recognized words}}{\text{Number of test words}} \times 100$$

2. **Substitution Error**

$$\text{Substitution error} = \frac{\text{Number of substituted words}}{\text{Number of test words}} \times 100$$

3. **No Response Error**

$$\frac{\text{Number of no responses}}{\text{Number of test words}} \times 100$$

4. **Insertion Error**

$$\text{Insertion error} = \frac{\text{Number of insertion error}}{\text{Number of test words}} \times 100$$

Voice Recognition Applications

Voice mail integration: The voice-mail message can be integrated with e-mail messages to create an integrated message.

DataBase Input and Query Applications

A number of applications are developed around the voice recognition and voice synthesis function. The following lists a few applications which use Voice recognition.

- Application such as order entry and tracking

It is a server function; It is centralized; Remote users can dial into the system to enter an order or to track the order by making a Voice query.

- Voice-activated rolodex or address book

When a user speaks the name of the person, the rolodex application searches the name and address and voice-synthesizes the name, address, telephone numbers and fax numbers of a selected person. In medical emergency, ambulance technicians can dial in and register patients by speaking into the hospital's centralized system.

Police can make a voice query through central data base to take follow-up action ifhe catch any suspect.

Language-teaching systems are an obvious use for this technology. The system can ask the student to spell or speak a word. When the student speaks or spells the word, the systems performs voice recognition and measures the student's ability to spell. Based on the student's ability, the system can adjust the level of the course. This creates a self-adjustable learning system to follow the individual's pace.

Foreign language learning is another good application where"' an individual student can input words and sentences in the system. The system can then correct for pronunciation or grammar.