Unit 12 Interaction Devices

Structure:

12.1 Introduction

In the previous unit, you learnt about software tools, its specification and methods. In this unit, you will study about interaction devices such as keyboard, pointing devices, speech recognition device, image and video displays and drivers.

Displays are human-made artifacts designed to support the perception of relevant system variables and to facilitate further processing of that information. Before a display is designed, the task that the display is intended to support must be defined (e.g. navigating, controlling, decision making, learning, entertaining, etc.). A user or operator must be able to process whatever information that a system generates and displays; therefore, the information must be displayed according to principles in a manner that will support perception, situation awareness, and understanding. This unit gives the complete picture of the keyboard, displays, speech and image in the design of user interface.

Objectives

After studying this unit, you should be able to:

- discuss the keyboard issues in interface design
- explain the use of pointing devices in user interface design
- discus on speech reorganization device
- explain the important features and principles of display design

12.2 Keyboard

In computing, a keyboard is typewriter keyboard, which uses an arrangement of buttons or keys, to act as mechanical levers or electronic switches. After punch cards and paper tape, interaction via teletype-style keyboards became the main input device for computers. This section discusses the features of different keyboard layouts.

QWERTY layout *is a* good mechanical design and a clever placement of the letters that slowed down the users enough that key jamming was infrequent it put frequently used letter pairs far apart, thereby increasing finger travel distances.

Dvorak layout reduces finger travel distances by at least one order of magnitude, Acceptance has been slow despite the dedicated efforts of some devotees, it takes about 1 week of regular typing to make the switch, but most users have been unwilling to invest the effort.

In ABCDE style 26 letters of the alphabet laid out in alphabetical order. Non typists will find it easier to locate the keys.

IBM PC keyboard was widely criticized because of the placement of a few keys such as backslash key where most typists expect SHIFT key placement of several special characters near the ENTER key, Number pad layout and wrist and hand placement

Features of keys

The following point lists the features of keys in the key board and purpose of function keys in the keyboard.

- 1/2 inch square keys
- 1/4 inch spacing between keys
- Keys have slight concave surface
- Keys have matte finish to reduce glare finger slippage
- Key require 40- to 125-gram force to activate
- Keys should provide 3 to 5 millimeters displacement
- Certain keys should be larger (e.g. ENTER, SHIFT, CTRL)
- some keys require state indicator, such as lowered position or light indicator (e.g. CAPS LOCK)
- key labels should be large, meaningful, permanent

- some "home" keys may have additional features, such as deeper cavity or small raised dot, to help user locate their fingers properly (caution - no standard for this)

Function keys

- users must either remember each key's function, identify them from the screen's display, or use a template over the keys in order to identify them properly
- can reduce number of key strokes and errors
- meaning of each key can change with each application
- placement on keyboard can affect efficient use
- special-purpose displays often embed function keys in monitor bezel
- lights next to keys used to indicate availability of the function, or on/off status
- Typically simply labeled F1, F2, etc, though some may also have meaningful labels, such as CUT, COPY, etc.
- frequent movement between keyboard home position and mouse or function keys can be disruptive to use
- alternative is to use closer keys (e.g. ALT or CTRL) and one letter to indicate special function

For cursor movement up, down, left, right keys are used, some keyboards also provide diagonals also the best layout of these keys is natural positions. Inverted-T positioning allows users to place their middle three fingers in a way that reduces hand and finger movement, cross arrangement better for novices than linear or box, typically include typamatic (auto-repeat) feature. Other movements may be performed with other keys, such as TAB, ENTER, HOME, etc.

For small devices Wireless or foldable keyboards, Virtual keyboards, Cloth keyboards, Soft keys and Pens and touch screens keypads can be used few such keyboard are shown in the fig 12.1.

Fig. 12.1: Keyboard and keypads for small devices

Self Assessment Questions

1. _____ *l*ayout reduces finger travel distances by at least one order of magnitude
2. _____ keys can reduce number of keystrokes and errors.

12.3 Pointing Devices

A **pointing device** is an input interface (specifically a human interface device) that allows a user to input spatial (i.e., continuous and multi-dimensional) data to a computer. CAD systems and graphical user interfaces (GUI) allow the user to control and provide data to the computer using physical gestures – point, click, and drag – for example, by moving a hand-held mouse across the surface of the physical desktop and activating switches on the mouse. Movements of the pointing device are echoed on the screen by movements of the pointer (or cursor) and other visual changes. Pointing devices are applicable in six types for interaction tasks they are

1) Select:

User chooses from a set of items. Used for traditional menu selection, identification of a file in a directory, or marking of a part in an automobile design.

2) Position
User chooses a point in a one, two, three, or higher-dimensional space. Used to create a drawing, to place a new window, or to drag a block of text in a figure.

3) Orient:
User chooses a direction in a two, three, or higher-dimensional space. Direction may simply rotate a symbol on the screen, indicate a direction of motion for a space ship, or control the operation of a robot arm.

4) Path:
User rapidly performs a series of position and orient operations. May be realized as a curving line in a drawing program, the instructions for a cloth cutting machine, or the route on a map.

5) Quantify:
User specifies a numeric value. Usually a one-dimensional selection of integer or real values to set parameters, such as the page number in a document, the velocity of a ship, or the amplitude of a sound.

6) Text:
User enters, moves, and edits text in a two-dimensional space. The pointing device indicates the location of an insertion, deletion, or change. More elaborate tasks, such as centering; margin setting; font sizes; highlighting, such as boldface or underscore; and page layout.

There are two types of pointing devices Direct-control pointing devices and Indirect pointing devices. Let’s discuss these one by one.

i) Direct-control pointing devices
Light pen enables users to point to a spot on a screen and to perform a select, position, or other task. It allows direct control by pointing to a spot on the display. Incorporates a button for the user to press when the cursor is resting on the desired spot on the screen. Lighten has three disadvantages: users' hands obscured part of the screen, users had to remove their hands from the keyboard, and users had to pick up the lighten.

Touch screen allows direct control touches on the screen using a finger. early designs were rightly criticized for causing fatigue, hand-obscuring-the-screen, hand-off-keyboard, imprecise pointing, and the eventual smudging of the display, lift-off strategy enables users to point at a single pixel, the

users touch the surface then see a cursor that they can drag around on the display. When the users are satisfied with the position, they lift their fingers off the display to activate can produce varied displays to suit the task are fabricated integrally with display surfaces

ii) Indirect pointing devices

- *Mouse:* the hand rests in a comfortable position, buttons on the mouse are easily pressed, even long motions can be rapid, and positioning can be precise
- *Trackball:* usually implemented as a rotating ball 1 to 6 inches in diameter that moves a cursor
- *Joystick:* are appealing for tracking purposes
- *graphics tablet:* a touch-sensitive surface separate from the screen
- *touchpad:* built-in near the keyboard offers the convenience and precision of a touchscreen while keeping the user's hand off the display surface

Self Assessment Questions

3. _____ enables users to point to a spot on a screen and to perform a select, position, or other task.
4. _____ allows direct control touches on the screen using a finger.
5. Movements of the _____ device are echoed on the screen by movements of the pointer and other visual changes.

12.4 Speech Recognition Devices

Speech recognition still does not match the fantasy of science fiction. It demands user's working memory, background noise problematic, and variations in user speech performance impacts effectiveness. Speech recognition are most useful in specific applications, such as to benefit handicapped users.

Discrete word recognition recognizes individual words spoken by a specific person, it can work with 90 to 98 percent reliability for 20 to 200 word vocabularies. It is Speaker-dependent training in which the user repeats the full vocabulary once or twice. Speaker-independent systems are beginning to be reliable enough for certain commercial applications. It has been

successful in enabling bedridden, paralyzed, or otherwise disabled people also useful in applications with at least one of the following conditions:

- speaker's hands are occupied
- mobility is required
- speaker's eyes are occupied
- harsh or cramped conditions preclude use of keyboard

When you compare voice-controlled editor and keyboard editor the first one as lower task-completion rate, lower error rate and can use disrupt problem solving.

Continuous-speech recognition is not generally available it as a difficulty in recognizing boundaries between spoken words, normal speech patterns blur boundaries and they have many potentially useful applications.

Voice mail users can receive messages, replay messages, reply to caller, forward messages to other users, delete messages and archive messages and these *Systems are of low cost and they are reliable.*

In *Voice information systems* stored speech is commonly used to provide information about tourist sites, government services, and after-hours messages for organizations. They are of Low cost.

Speech generation is "frequently preferable" under these circumstances:

- The message is simple.
- The message is short.
- The message will not be referred to later.
- The message deals with events in time.
- The message requires an immediate response.
- The visual channels of communication are overloaded.
- The environment is too brightly lit, too poorly lit, subject to severe vibration, or otherwise unsuitable for transmission of visual information.
- The user must be free to move around.
- The user is subjected to high G forces or anoxia

Audio tones, audiolization and music Sound feedback can be important to confirm actions, offer warning for visually-impaired users. Music is used to provide mood context, e.g. in games it can provide unique opportunities for user, e.g. with simulating various musical instruments.

Synthesized speech

Synthesized Speech can be used as an alternative way of presenting display messages for people who have difficulty in reading them. However, poor quality synthetic speech can be difficult for people with a mild hearing impairment to understand; therefore the user should be provided with a means of repeating the message.

The following guidelines are suggested for synthesized speech:

- Make the voice as natural as possible. If the choice of messages is relatively limited, use human voices because they are more intelligible and are preferred over synthetic voices.
- If multiple voices are used, present warnings in a different voice from the others. The user needs to be able to distinguish between types of information.
- Provide a means for the user to replay a message if it is missed.
- Experienced users should be provided with a means to interrupt familiar messages.
- Non-speech audio messages should only be used to alert the user, not to supply information.

Self Assessment Questions

6. Speech recognition can work with _____ percent reliability for 20 to 200 word vocabularies
7. In _____ systems stored speech is commonly used to provide information about tourist sites.

12.5 Image and Video Displays

The display has become the primary source of feedback to the user from the computer. The display has many important features which includes physical dimensions (usually the diagonal dimension and depth), resolution (the number of pixels available), number of available colors, color correctness, luminance, contrast, and glare, power consumption, refresh rates (sufficient to allow animation and video), cost and reliability

There are various technologies used for Display few of them are mentioned below

1) *Monochrome displays: they* are adequate, and are attractive because of their lower cost

2) *RGB shadow-mask displays: in this* small dots of red, green, and blue phosphors are packed closely
3) *Raster-scan cathode-ray tube (CRT): in these* electron beam sweeping out lines of dots to form letters it as refresh rates of 30 to 70 per second
4) *Liquid-crystal displays (LCDs): In these types voltage* changes influence the polarization of tiny capsules of liquid crystals, they are flicker-free and they have a size of the capsules which limits the resolution.
5) *Plasma panel: in these* rows of horizontal wires are slightly separated from vertical wires by small glass-enclosed capsules of neon-based gases.
6) *Light-emitting diodes (LEDs): in these* certain diodes emit light when a voltage is applied and arrays of these small diodes can be assembled to display characters.
7) *Electronic ink: in these* Paper like resolution is used. Tiny capsules with negatively and positively charged particles.
8) *Braille displays:* in these Pins provide output for the blind
9) *Large displays:* Informational wall displays, Interactive wall displays and multiple desktop displays.
10) *Heads-up and helmet mounted displays:* A heads-up display can be used, for instance, to project information on a partially silvered widescreen of an airplane or car, a **helmet mounted display** (HMD) is a device used in some modern aircraft, especially combat aircraft. HMDs project information similar to that of heads up displays (HUD) on an aircrew's visor or reticle, thereby allowing him to obtain situational awareness and/or cue weapons systems to the direction his head is pointing.

12.5.1 Display design

Displays are human-made artifacts designed to support the perception of relevant system variables and to facilitate further processing of that information. Before a display is designed, the task that the display is intended to support must be defined (e.g. navigating, controlling, decision making, learning, entertaining, etc.). A user or operator must be able to process whatever information that a system generates and displays; therefore, the information must be displayed according to principles in a

manner that will support perception, situation awareness, and understanding.

There are ***thirteen principles of display design.*** These principles of human perception and information processing can be utilized to create an effective display design, A reduction in errors, a reduction in required training time, an increase in efficiency, and an increase in user satisfaction are a few of the many potential benefits that can be achieved through utilization of these principles.

Certain principles may not be applicable to different displays or situations. Some principles may seem to be conflicting, and there is no simple solution to say that one principle is more important than another. The principles may be tailored to a specific design or situation. Striking a functional balance among the principles is critical for an effective design. Come Let us understand them.

First five principles are *perceptual principles*

1) Make displays legible (or audible)

A display's legibility is critical and necessary for designing a usable display. If the characters or objects being displayed cannot be discernible, then the operator cannot effectively make use of them.

2) Avoid absolute judgment limits

Do not ask the user to determine the level of a variable on the basis of a single sensory variable (e.g. color, size, loudness). These sensory variables can contain many possible levels.

3) Top-down processing

Signals are likely perceived and interpreted in accordance with what is expected based on a user's past experience. If a signal is presented contrary to the user's expectation, more physical evidence of that signal may need to be presented to assure that it is understood correctly.

4) Redundancy gain

If a signal is presented more than once, it is more likely that it will be understood correctly. This can be done by presenting the signal in alternative physical forms (e.g. color and shape, voice and print, etc.), as redundancy does not imply repetition. A traffic light is a good example of redundancy, as color and position are redundant.

5) Similarity causes confusion: Use discriminable elements

Signals that appear to be similar will likely be confused. The ratio of similar features to different features causes signals to be similar. For example, A423B9 is more similar to A423B8 than 92 is to 93. Unnecessary similar features should be removed and dissimilar features should be highlighted.

Sixth and seventh are ***mental model principles***

6) Principle of pictorial realism

A display should look like the variable that it represents (e.g. high temperature on a thermometer shown as a higher vertical level). If there are multiple elements, they can be configured in a manner that looks like it would in the represented environment.

7) Principle of the moving part

Moving elements should move in a pattern and direction compatible with the user's mental model of how it actually moves in the system. For example, the moving element on an altimeter should move upward with increasing altitude.

8th 9th and 10th ***principles are based on attention***

8) Minimizing information access cost

When the user's attention is diverted from one location to another to access necessary information, there is an associated cost in time or effort. A display design should minimize this cost by allowing for frequently accessed sources to be located at the nearest possible position. However, adequate legibility should not be sacrificed to reduce this cost.

9) Proximity compatibility principle

Divided attention between two information sources may be necessary for the completion of one task. These sources must be mentally integrated and are defined to have close mental proximity. Information access costs should be low, which can be achieved in many ways (e.g. close proximity, linkage by common colors, patterns, shapes, etc.). However, close display proximity can be harmful by causing too much clutter.

10) Principle of multiple resources

A user can more easily process information across different resources. For example, visual and auditory information can be presented simultaneously rather than presenting all visual or all auditory information.

11th 12th and 13th are ***memory principles***

11) Replace memory with visual information: knowledge in the world

A user should not need to retain important information solely in working memory or to retrieve it from long-term memory. A menu, checklist, or another display can aid the user by easing the use of their memory. However, the use of memory may sometimes benefit the user by eliminating the need to reference some type of knowledge in the world (e.g. an expert computer operator would rather use direct commands from memory than refer to a manual). The use of knowledge in a user's head and knowledge in the world must be balanced for an effective design.

12) Principle of predictive aiding

Proactive actions are usually more effective than reactive actions. A display should attempt to eliminate resource-demanding cognitive tasks and replace them with simpler perceptual tasks to reduce the use of the user's mental resources. This will allow the user to not only focus on current conditions, but also think about possible future conditions. An example of a predictive aid is a road sign displaying the distance from a certain destination.

13) Principle of consistency

Old habits from other displays will easily transfer to support processing of new displays if they are designed in a consistent manner. A user's long-term memory will trigger actions that are expected to be appropriate. A design must accept this fact and utilize consistency among different displays.

Self Assessment Questions

8. In _____ device diodes emit light when a voltage is applied.
9. State principle of pictorial realism.

_____

_____

12.5.2 Image and representation

Understanding how signs are formed, transmitted, and interpreted can help the designer to systematically analyze a communication problem and develop an appropriate solution. The visual language used to represent the system's functionality must therefore be as coherent as possible and must match the expected user's capabilities. With an understanding of the user

population, the designer can determine the representation and the degree of abstraction most appropriate for their existing background, skills and tasks.

As exemplified in Fig. 13, effective visual imagery can be created even by those who do not consider themselves to possess much artistic talent. More important than artistic skill, is an appreciation for the role of imagery and a knowledge and understanding of the correct use of visual language. Neither textual nor iconic representations are inherently superior. The best method of communicating a concept depends on the task itself:

Fig. 12.3: Visual Imagery

These buttons use iconic imagery to indicate paragraph alignment. Note how internal cohesiveness is achieved by repeating elements and using common line weights.

A crucial aspect of visual imagery is the speed and directness of recognition and identification. Selecting the correct approach for a particular communication task is more a discipline than a technique. The following guidelines will help in selecting a correct approach.

- Use an icon if the concept to be communicated is a familiar object or an externally obvious state.
- Consider developing a conventional symbol if the concept will be used repeatedly throughout an application, especially if an existing sign can be borrowed from the real world.
- Otherwise, use a textual label, especially if the concept to be communicated is an abstract process or a subtle transition between states.
- Avoid mixing text, icons and symbols within a single image.

Abstraction is the process by which the essential qualities of the object or event being represented are separated from the actual object or event. By removing superficial details, the designer helps the viewer see the formal qualities that tie the representation to its object. It begins with a literal representation and works backward to extract the essence of the target object. Many of the techniques described above are also applicable here.

The process of creating an image set is as follows:

- Determine the appropriate level of abstraction for the image set based on subject matter, audience, and display resolution.
- Start with an image seen from the viewpoint that includes the most significant contours.
- Use a trace overlay to rapidly develop a series of sketches derived from the first image. Progressively eliminate detail until only the most essential distinguishing elements remain. Experiment with different arrangements of elements to identify those that best depict the object.
- Simplify complex shapes into regular geometrical forms.
- Eliminate contour information that is not needed to recognize the object. Experiment with white space to suggest contours.

For a set of images to work together effectively, they must share a coherent form that makes every image in the group obviously interrelated. Consistency is especially important in an image set, because images can completely dominate the interface if there is too much variety. Images should therefore be coordinated so that they form a perceptual layer of their own. Users can then ignore the images when appropriate, or take notice of them when needed.

Achieving consistency is a matter of equating as many of the images visual qualities as possible. Uniformity within the image set helps differentiate its members from images outside the set, and makes the individual members stand out more. This is because their distinguishing features present themselves more strongly as local inconsistencies. Once the design constraints are made clear, it is easy to expand the set by adding new images:

- Use identical points of view and perspectives for each image. Determine the principal viewpoint and redraw any differing images from the new perspective.
- Use a similar form of representation and level of abstraction. Don’t combine icons with symbols.
- Use a consistent size, orientation, layout, color and overall visual weight for each image. Use a layout grid to help ensure internal consistency among images.

- Use the same elements throughout the image set, such as line weights, curves, textures and forms.

Self Assessment Questions

10. _____ is the process by which the essential qualities of the object or event being represented are separated from the actual object or event.
11. Achieving consistency is a matter of equating as many of the images visual qualities as possible. (True/False)

12.5.3 Software accessibility

A product designed for accessibility often enhances the usability of that product for all people regardless of ability. Accessible design features often go unnoticed, such as volume control buttons. The IBM Software Accessibility Checklist for general software applications (IBM 2004) recommends the following:

1) Keyboard Access

- *Keyboard equivalents*: Provide keyboard equivalents for all actions. Users who are unable to use the mouse need all functions to be available via the keyboard.
- *Built-in accessibility*: Do not interfere with keyboard accessibility features built into the operating system. Many operating systems have a set of accessibility options that enable users with disabilities to customise system-wide settings to improve accessibility.

2) Object Information

- *Focus:* Provide a visual focus indicator that moves among interactive objects as the focus changes. This indicator must be programmatically exposed to assistive technology. Assistive technology needs to know the position and contents of the visual focus indicator so it can appropriately convey that information to the user.
- *User Interface Objects*: Provide semantic information about user interface objects. When an image represents a program element, the information conveyed by the image must also be available in the text. Assistive technology will then be able to convey the identity of the focus object as well as its role and state to the user.

- *Labels:* Associate labels with controls, objects, icons and images. If an image is used to identify programmatic elements, the meaning of the image must be consistent throughout the application.
- *Forms*: When electronic forms are used, the form should allow people with assistive technology to access the information, field elements and functionality needed to complete and submit the form, including all directions and cues. Accessibility of the form depends on proper coding of the controls so the information is exposed to screen readers.

3) *Sound and Multimedia*
   - *Audio alerts*: Provide an option to display a visual cue for all audio alerts.
   - *Significant audio and video*: Provide accessible alternatives to significant audio and video. Alternatives are also needed for those with hardware or environmental limitations.
   - *Volume*: Provide an option to adjust the volume.

4) *Display*
   - *Text:* Provide text through standard system functions calls or through an API that supports interaction with assistive technology. Screen readers use an Off-screen Model (OSM) to get information such as text content, text input caret location, and text attributes. If text is displayed in a non-standard way, the screen reader will not be able to read the information to the user.
   - *Colour*: Use colour as an enhancement, not as the only way to convey information or indicate an action.
   - *Contrast*: Support system settings for high contrast for all user interface controls and client area content.
   - *Customisation:* When colour customisation is supported, provide a variety of colour selections capable of producing a range of contrast levels.
   - *System settings*: Inherit system settings for font, size and colour for all user interface controls.
   - *Animation*: Provide an option to display animation in a non-animated presentation mode.

5) Timing

- *Response times*: Provide an option to adjust the response times on timed instructions, or allow the instructions to persist. When a timed response is needed, alert the user and give sufficient time to indicate more time is required. Some users have difficulty reading or responding to information if it is displayed briefly or requires a quick response time. Some response delays may also be caused by assistive technologies.
- *Blinking elements*: Avoid causing text, objects and other elements to blink, flicker, or move. Flickering or flashing content can cause seizures in some people.

6) Documentation

- *Format:* Provide documentation in an accessible format such as HTML and accessible PDF.
- *Content*: Provide documentation on all accessibility features including keyboard access. People with disabilities need to know how to use the accessibility features.
- Verify accessibility features using available tools.

7) Web Accessibility

Accessibility does not mean that every page should be limited to plain text. Instead, it involves providing alternatives to an otherwise inaccessible feature The IBM Web Accessibility Checklist for websites and web applications (IBM, 2004) recommends the following:

- *Images*: Use appropriate alternative text for images.
  - Use the alt="text “attributes to provide text equivalents for images.
  - Use alt=""for images that do not convey important information or convey redundant information.
  - Alternative text is also used by text-only browsers, display less devices such as mobile phone browsers, and by search engines.
- *Image Maps*: Use client-side image maps and alternative text for image map hot spots.
  - If a server-side map is needed, provide equivalent text links.
  - Server-side image maps are currently not accessible to anyone using non-graphical browsers or browsers with images turned off.

  - Client-side image maps are accessible when the alternative text is supplied for each area of the image map.
  - Provide alternative text for the image map itself as well.
- *Graphs and charts*: Summarise the content of each graph and chart, or use the long attribute to link to the description or data. The amount of alternative information to provide depends on the contextual use of the chart or graph, but generally it should include all the information available to the sighted user.
- *Multimedia*: Provide captions or transcripts of important audio content. Provide audio descriptions of important video content.
- *Scripts*: Ensure the functionality of scripts is accessible via the keyboard. If the content affected by scripting is not accessible, provide an alternative. If the essential tasks can be accomplished with scripting turned off, then the scripting does not need to be directly accessible.
- *Non-HTML content*: When an applet, plug-in or other application needs to be present, provide a link to one that is directly accessible or provide alternate content.
- *Forms:* Make forms accessible to assistive technologies. Labels must be explicitly associated with the FORM elements through HTML mark-up.
- *Skip to main content*: Provide methods for skipping over navigation links to get to the main content of a page.
- *Frames*: Provide a title for each frame element and frame page. Provide an accessible source for each frame. People who use text browsers or assistive technologies must choose which frame to open when they visit a frameset page.

  If the source of the frame is an image file there is no opportunity to add the alt attribute to the image.
- *Table Headers*: Use the element to mark-up the table heading cells. Use the headers attribute on complex databases.
- *Cascading Style Sheets*: Web pages should be readable without requiring style sheets.
- CSS describes how elements in a web page are *presented*, not how the page is structured. Structure refers to, for example, what is a heading, what is content, what is tabular data.

- Use CSS, not tables, for web page layout because nested tables are interpreted by screen readers as displaying data.
- Not all browsers and assistive technologies support CSS well.

8) Personal Assistive Technologies

Many people with disabilities need devices to help them render content. These devices may be referred to as *access systems*, *assistive technology*, *adaptive technology* and *adaptive computing*. However, these are expensive to buy and maintain.

9) Output Devices

Screen readers and voice browsers are software applications that are combined with text-to-speech synthesizers to locate and read aloud the information on a computer screen to users who are blind, and are also useful to those with learning disabilities. They usually work closely with the operating system and rely on the system's built-in capabilities, so applications that override system settings can be unusable for some people.

Screen magnifiers are used to increase the size of text or images on a computer screen, and may also allow users to change the default colors of the display. They usually do this by tracking the active region of the screen, indicated by the cursor, and automatically enlarge that portion of the screen. Using custom cursors may result in a compatibility issue, with the magnifier enlarging the wrong portion of the screen.

Refreshable Braille displays are tactile hardware devices that raise or lower dot patterns on command from a computer, resulting in a dynamically changing line of Braille. They are the primary means of computer access for deaf-blind users.

10) Input Devices

Speech recognition software, coupled with an input device such as a microphone, allows a user to issue commands that an application can recognise and act upon. *Head-pointing devices and eye trackers* allow a user to move the cursor on the screen just by moving their head or eyes.

Adaptive keyboards are designed for users with limited dexterity. Adaptive keyboards may be small for users with limited range of movement, or large for users without fine motor control. They may offer fewer choices for those with learning disabilities, or be one-handed for those who have the use of

only one hand. For users that can only use a mouse (or mouse-emulating technology), the keyboard can be displayed on the screen itself, and typing can be replaced by pointing to the letters using a mouth stick, pen or finger. Applications that attempt to interrogate the keyboard directly, bypassing the operating system, are unlikely to be accessible to users with adaptive keyboards.

Single switches are devices for users with severe physical disabilities and can only execute one or two specific movements to operate a computer. It operates in conjunction with scanning software. When the desired option is highlighted during scanning, the user triggers the switch to select it.

Self Assessment questions

12. _____ keyboards are designed for users with limited dexterity.
13. _____ is a device for users with severe physical disabilities and can only execute one or two specific movements to operate a computer.

12.6 Summary

In this unit you learnt about interaction devices such as keyboard, pointing devices, speech recognition device, image and video displays and drivers.

The section 12.2 gives the features of different keyboard layouts used. Synthesized Speech can be used as an alternative way of presenting display messages for people who have difficulty in reading them. However, poor quality synthetic speech can be difficult for people with a mild hearing impairment to understand; therefore the user should be provided with a means of repeating the message. The guidelines are suggested for synthesized speech in the section 12.4.

Understanding accessibility barriers is the first step in ensuring that the interface of any application can be designed in such a way that as many people as possible can use the application. The accessibility guidelines provided in this unit reflect only a portion of the research that has been conducted in this field, and the interface designer is encouraged to explore in detail, the sources provided in this unit. In developing any application, the software designer must be aware of accessibility issues, and the methods by which they can be overcome. In doing this, the designer not only makes an application accessible to people with disabilities, they also make it easier to use for those without disabilities.

12.7 Terminal Questions

1. Explain the keyboard layouts and function keys.
2. Explain the types of interaction tasks where pointing devices are applicable.
3. Describe the guidelines for synthesized speech.

12.8 Answers

Self Assessment Questions

1. Dvorak layout
2. Function
3. light pen
4. Touch screen
5. Pointing
6. 90 to 98
7. Voice information.
8. Light-emitting diodes
9. A display should look like the variable that it represents if there are multiple elements, they can be configured in a manner that looks like it would in the represented environment.
10. Abstraction
11. True
12. Adaptive
13. Single switches

Terminal Questions

1. Three types of layouts are QWERTY layout, Dvorak layout and In ABCDE style. (Refer section 12.2 for detail)
2. A pointing device is an input interface (specifically a human interface device) that allows a user to input spatial (i.e., continuous and multi-dimensional) data to a computer. (Refer section 12.3)
3. Make the voice as natural as possible. If the choice of messages is relatively limited, use human voices because they are more intelligible and are preferred over synthetic voices. (Refer section 12.4)