



Chapter-8

Multimedia System (Pokhara University)



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Chapter 8 - User Interfaces

User interface is the layer of the software or the program with which the end users interact in order to get his things done for e.g. processing of the information. This interaction today occurs with a graphical layer with which the user can interact with several input devices like keyboard, mouse, track balls, data gloves etc. Multimedia user interface is just another computer interface where the users can interact with the computer by the use of multiple media, sometimes using multiple modes such as written text together with spoken language. Example is Microsoft word where the user can document his information either by giving input through the keyboard or through the microphone.

However there are still many well known problems with current user interfaces. One problem is *computer interaction* which is still not that natural and effective. For example still we cannot tell (use voice) to give commands to computer to carry out a task. Yet, computer programs are in evolutionary trend and we already have few software packages that allows user to literally command the computer.

Another problem is the *specification of object movement*. A specification of movements using graphics or text is often much more difficult and complicated than using a motion video. The development of user interface is heading toward more effective and interactive interfaces using new interactive devices, which is an area of research in the field of *virtual reality*.

General Design Issues

The main emphasis in the design of multimedia user interfaces is multimedia presentation.

There are several issues which must be considered:

- ✓ To determine the appropriate information content to be communicated.
- ✓ To represent the essential characteristics of the information.
- ✓ To represent the communicative intent.
- ✓ To choose the proper media for information presentation.
- ✓ To provide interactive exploration of the information presented.

Architectural Issues

An effective presentation design should be as interactive as it is informative. The user should have the freedom to choose the direction of navigation. This should be supported by user – oriented goals, context sensitive help and selection of proper media in order to represent the information.

Information Characteristics for Presentation

The complete set of information characteristics makes knowledge definition and representation easier because it allows for appropriate mapping between information and presentation techniques.

The information characteristics specify:

Types

The data type we use to represent the information should be properly selected. It is basically done of ordering of data and there can be two types of ordering and they are:

- ✓ *coordinates versus amount*, which signify points in time, space or other domains.
- ✓ *intervals versus ratio*, which suggests the types of comparisons meaningful among elements of coordinate and amount data types.

Relational Structures

This group of characteristics refers to the way in which a relation maps among its domain sets (dependency). There are *functional dependencies* and *non-functional dependencies*.

Multi-domain Relations

Relations can be considered across multiple domains, such as (i) *multiple attributes* of single object set (e.g., positions, colors, shapes, and/or sizes of a set of objects in a chart); ii) *multiple object sets* (e.g., a cluster of text and graphical symbols on a map); and iii) *multiple displays*.

Large Data Sets

Large data sets refer to numerous attributes of collections of heterogeneous objects.

Presentation Function

These are the modules or methods which are used to display the information objects before the user. This presentation function should be independent from presentation form, style or the information it conveys.

Presentation Design Knowledge

To design a presentation, issues like *content selection*, *media* and *presentation technique selection* and *presentation coordination* must be considered.

Content selection is making a choice of the information that should be presented before the user. The information should be simple and revealing.

Media selection is making choice of the media that is used to convey the content. The selection of the media is governed by the characteristics of the information itself. For e.g. the numerical data can be effectively presented with the help of graph while audio would be suitable for narration.

Coordination can be viewed as a process of composition. Coordination needs mechanisms such as:

- ✓ encoding techniques (e.g., among graphical attributes, sentence forms, audio attributes, or between media)
- ✓ presentation objects that represent facts (e.g., coordination of the spatial and temporal arrangement of points in a chart)
- ✓ multiple displays (e.g., windows)

Effective Human-Computer Interaction

One of the most important issues regarding multimedia interfaces is effective human-computer interaction of the interface, i.e., *user-friendliness*. The main issues the user interface designer should keep in mind are:

- ✓ context
- ✓ linkage to the world beyond the presentation display
- ✓ evaluation of the interface with respect to other human-computer interfaces;
- ✓ interactive capabilities and
- ✓ Separability of the user interface from the application

Video at the User Interface

Video is actually the continuous sequence of still images such that the rate of replacement of images is 15 images per second (however for better quality 30 images per second is used). Thus the video can be manipulated using the interface that is used to manipulate the image.

The user should be allowed to navigate through the video both in the forward or backward direction possibly by the use of slider. The properties of the video like the contrast, sharpness should be adjustable and if there is audio too the user should be allowed to fine tune it. These functionalities are not as simple to deliver because of the high data transfer rate necessary is not guaranteed by most of the hardware in current graphics systems.

Hardware for Visualization of Motion Pictures

Special hardware for visualization of motion pictures is available today, mostly through additional video cards. Most motion video components integrated in a window system use chroma-key methods where an application generates a video window with a certain color.

Example: Remote Camera Control Application

Let us assume the case of a camera where the user controls it from some remote location. For e.g. let us assume that the users' on earth are controlling the camera on a space robot. Following are the points to be considered:

Application Specification

The camera is connected to the computer either with a wire or wirelessly (in the case of space robot it is connected wirelessly). The controller sends the command to focus, zoom, and rotate accordingly. The image content should be compressible and digital in format.

User Interface

The user interface should obviously be graphical and instead of simple rectangular buttons for rotating the camera a circular button or a circular slider would be more user friendly. Similarly for the movement of the camera the user would feel easy if buttons are used rather than giving the values. The speed of the robot could be controlled with the slider. The arrow keys *left*, *right*, *up* and *down* would move the camera in the corresponding directions.

Direct Manipulation of the Video Window

(1) Absolute Positioning

For e.g. if the user wants to focus on some object he simply clicks the object and the camera turns toward the object to get the object at its central focus. This is the process of absolute positioning.

(2) Relative Positioning

Here the user is not allowed to click on the object he wants the camera to focus, instead he uses arrow keys or the buttons at the graphical interface to move the camera accordingly. When the mouse button is released, the camera movement stops. This kind of manipulation of the video window is called *relative positioning*.

Audio at the User Interface

Audio can be implemented at the user interface for application control. Thus speech analysis is necessary. Speech analysis is either speaker-dependent or speaker-independent. *Speaker-dependent* solutions allow the input of approximately 25,000 different words with a relatively low error rate. Here, an intensive learning phase to train the speech analysis system for speaker-specific characteristics is necessary prior to the speech analysis phase. A *speaker-independent* system can recognize only a limited set of words and no training phase is needed.

During audio output, the additional presentation dimension of space can be introduced using two or more separate channels to give more natural distribution of sound. The best-known example of this technique is *stereo*. In the case of *monophony*, all audio sources have the

same spatial location. The sound application opens different audio sources using location identification. To each audio source there is assigned an *audio window* which appears on the screen at the location specified. The location of the source can be changed by moving the audio window. The number of audio windows is limited.

The concept of the audio window allows for application independent control of audio parameters, including spatial positioning. Most current multimedia applications using *audio* determine the spatial positioning themselves and do not allow the user to change it.

User-friendliness as the Primary Goal

User friendliness is the main property of a good user interface. The design of user-friendly graphical interface requires the consideration of many conditions. The addition of audio and video to the user interface does not simplify this process. The user-friendliness is implemented by-

Easy to Learn Instructions

The instructions guiding the use of interface should be easy to learn. The language should be simple and graphical.

Context-sensitive Help Functions

The appropriate help functions should be accessible when they are needed. A context-sensitive help function using hypermedia techniques is very helpful, i.e., according to the state of the application, different help-texts are displayed. For example, after selection the call re-routing function, the help function provides a brief explanation of call re-routing.

Easy to Remember Instructions

A user-friendly interface must also have the property that the user easily remembers the application instruction rules. Easily remembered instructions might be supported by the intuitive association to what the user already knows. For example, the user knows the phone book (register). Hence, the user interface of a telephone service, implemented in a multimedia system, can show the participant a list on the screen.

Effective Instructions

Following points should be considered:

- ✓ Logically connected functions should be presented together.
- ✓ Graphical symbols or short video clips are more effective than textual input and output.
- ✓ Different media should be able to be exchanged among different applications.
- ✓ Actions should be activated quickly. For example, in a telephone service the selection of a callee must be very fast.

Aesthetics

With respect to aesthetics, the color combination, character sets, resolution and form of the window need to be considered. They determine a user's first and lasting impressions. It is desirable to develop only one application for different users and languages.

Effective Implementation Support

An effective implementation of a user-friendly interface can be influenced by the following:

- ✓ If the users' requirements are missing, *Rapid Prototyping* should be used. This means that the user-interface is developed, changed and tested without filling in the contents of the actual programs.
- ✓ If window systems are used, the user interface becomes hardware-independent and the development effort is shorter.

Entry Elements

User interfaces use different ways to specify entries for the user:

Entries in a menu

In current menus there are visible and non-visible entry elements entries which are relevant to the particular task are visible.

Entries on a graphical interface

- ✓ If the interface includes text, the entries can be marked through color and/or a different font.
- ✓ If the interface includes images, the entries can be written over the image.
- ✓ If the interface includes images, the functions can be activated through direct positioning of the cursor on the image object.

Meaningful Location of Functions

Individual functions must be placed together in a meaningful fashion. This occurs through

- ✓ alphabetic ordering
- ✓ logical grouping

Dialogue Boxes

Different dialogue boxes should have a similar construction. This requirement applies to the design of

- ✓ the buttons OK and Abort
- ✓ Joined Windows
- ✓ Other applications in the same window system

Semantically similar entry functions can be located in one dialogue box instead of several dialogue boxes.

Presentation

The presentation, i.e., the optical image at the user interface, can have the following variants:

- ✓ Full text
- ✓ Abbreviated text
- ✓ Icons, i.e., graphics
- ✓ Micons, i.e., motion video

Design-specific Criteria

While designing the user interface the problem specific properties of the actual task need to be considered. For e.g. in designing the interface for controlling cameras, the use of sliders, rotators, buttons would be effective while for the word editors, graphical icons and use of menu and toolbars would be useful.

References:

- ✓ "Multimedia: Computing, Communications and Applications", Ralf Steinmetz and Klara Nahrstedt, Pearson Education Asia
- ✓ "Multimedia Communications, Applications, Networks, protocols and Standards", Fred Halsall, Pearson Education Asia
- ✓ "Multimedia Systems", John F. Koegel Buford, Pearson Education Asia

Assignments:

- (1) What are the issues which must be considered at design of multimedia user interface?
- (2) How can user interface be made user-friendly? Explain
- (3) What are the primary goals which should be considered at design of multimedia user interface?