

array are raised to stimulate the user's finger in areas corresponding to the lines of the visually displayed graph. In this manner, the displayed content itself is represented, i.e. the lines of the graphical information, as an illusion of raised features appearing underneath a user's fingers. Audio feedback is utilized to provide additional information about this graphical data, such as axis labels, graph names, titles. While this reference describes the use of two types of non-visual feedback, it teaches the use of these two types to represent various aspects of the non-partitioned content itself. This contrasts with the present invention, which provides one type of non-visual feedback to indicate spatial relationships between different displayed areas of separate content, while a second type of non-visual feedback indicates meta-information about the content in an area.

[0014] U.S. Pat. No. 5,977,867 is of general background interest in the sense that it describes an input device of a type that is similar to that preferably utilized in conjunction with the present invention.

[0015] The literature "Method for Providing Position Relative Audio Feedback in a Scrollable Content Area," IBM Research Disclosure, v42 n418 p 225, February 1999, describes the use of audio feedback based upon the current size and position of scrollable content within a window being displayed. Disclosed is the use of different sounds to indicate different frames, where the sounds indicate the size of the content within a given frame and the user's relative position within the content. The use of non-visual feedback to represent the page in a higher-level abstract representation, showing major sections in their approximate spatial relationships (e.g., top left, bottom center), however, is not described.

[0016] The literature, "Cooperative Web Navigation System for Blind and Sighted People," IBM TDB vol. 4 No. 11 p. 35, November 1997, describes a method to allow a sighted person and a blind person to share the same computer, either to do entirely separate work or cooperatively navigate the Web. Disclosed is the use of different input and output devices for a sighted user and blind user. A mouse and display is used for a sighted user, while a speaker and numeric pad are used for a blind person. However, no mechanism is described to allow a visually impaired user to understand and follow the overall layout of the visual representation of an information page.

SUMMARY OF THE INVENTION

[0017] A system and method is provided for non-visually displaying a multi-part information page containing different spatially located areas of separate content. To display the multi-part information page, a non-visual, abstract representation of the multi-part information page is maintained. This non-visual, abstract representation has non-visual display coordinates, which include boundary coordinates and content coordinates. The boundary coordinates define boundaries between the different spatially located areas and are associated with tactile feedback. The content coordinates define the different spatially located areas. Each of the content coordinates is associated with auditory feedback representative of content meta-information for the content of that area. Input position coordinates received from an input device are mapped to the non-visual display coordinates. When position input coordinates map to the boundary coordinates,

a tactile output is generated to cause a tactile output device to generate the associated tactile feedback. When position input coordinates map to the content coordinates an auditory output is generated. The auditory output causes an auditory output device to generate the auditory feedback associated with the content coordinates.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. 1a illustrates a typical distributed computing architecture.

[0019] FIG. 1b illustrates the general flow control in the preferred embodiment of the present invention.

[0020] FIGS. 2a and 2b illustrate an exemplary web page utilizing frames in which one of the content areas is changed.

[0021] FIG. 3a diagrammatically illustrates the steps performed by an intermediary after receiving web page data.

[0022] FIG. 3b illustrates a non-visual, abstract representation of the web page shown in FIGS. 2a and 2b.

[0023] FIG. 4 diagrammatically illustrates the steps performed by an interface component for non-visual display and to provide user interaction with the web page

[0024] FIG. 5 diagrammatically illustrates the steps performed when the intermediary receives a request from an interface component.

[0025] FIG. 6 depicts the use of the present invention with a large-scale projector and a laser pointer.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] While this invention is illustrated and described in a preferred embodiment, the invention may be produced in many different configurations, forms and materials. There is depicted in the drawings, and will herein be described in detail, a preferred embodiment of the invention, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and the associated functional specifications for its construction and is not intended to limit the invention to the embodiment illustrated. Those skilled in the art will envision many other possible variations within the scope of the present invention.

[0027] Exemplary Hardware Environment And Overview Of The Preferred Embodiment

[0028] FIG. 1a schematically illustrates an exemplary computer hardware environment for use with the present invention. More particularly, FIG. 1 illustrates a typical distributed computing architecture using a network 100, which may include LANs, WANs, SNA networks, wireless networks, as well as the Internet. Network 100 connects client computers 102, servers 104 and proxy servers 106, as well as possibly connecting other resources. Servers 104 typically are personal computers, workstations, minicomputers, or mainframes, while client computers 102 are typically personal computers, or workstations.

[0029] To exchange data with servers 104, client computers 102 have hardware and execute client software to create connections to servers 104 utilizing communications protocols, such as TCP/IP and HTTP. Servers 104 additionally