200101932-2
26 MAR 2001

A METHOD AND APPARATUS FOR SEARCH AND DISPLAY OF HIERARCHICALLY ORGANIZED INFORMATION OF ARBITRARY DEPTH USING GRAPHICAL USER INTERFACES

FIELD OF THE INVENTION

The present invention relates to a method and apparatus for search and display of hierarchically organized information of arbitrary depth using graphical user interfaces including web pages on an intranet or the Internet.

BACKGROUND OF THE INVENTION

As the amount of information that can be accessed from a computer increases, ways to usefully display that information are needed. A Graphical User Interface (GUI) is a visual computer environment that represents programs, files and options with graphical images, such as icons, menus, and dialog boxes on the screen. The user can select and activate these options by pointing and clicking with a mouse or with a keyboard. GUI provides standard software routines so that a particular item such as a scroll bar works the same way to the user in all applications. GUI's now have the ability to call a variety of resources to locate and display information. A user can use a GUI to establish a connection through a telecommunications network or to transfer

program execution to some section of code while saving the necessary information to allow execution to resume at the calling point when the called section has completed execution.

While GUI simplifies moving through data, the user's reach is greatly extended by the ability of one computer to connect to one or more additional computers. The Internet is a wide area network connecting thousands of disparate networks in industry, education, government and research. The Internet uses the Transmission Control Protocol/ Internet Protocol (TCP/IP) as the standard for transmitting information. An intranet is a network of organizational networks that run TCP/IP protocols and where the organizational networks are internal to a single organization. An intranet may be connected to the internet.

The Transmission Control Protocol (TCP) is the protocol within TCP/IP that governs the breakup of data messages into packets to be sent via IP. The total set of interlinked hypertext documents residing on Hypertext Transfer Protocol (HTTP) servers all around the world is called the World Wide Web. HTTP is the protocol used to carry requests from a browser to a Web server and to transport pages back to the requesting browser.

Documents on the World Wide Web are called Web pages are written in Hypertext Markup Language (HTML). HTML is an application of Standardized Generalized Markup Language (SGML) that uses tags to mark elements, such as text and graphics, in a document to indicate how Web browsers should display these elements to the user and should reason to user actions such as activation of a line by means of a key press or mouse click. Web pages are identified by URL (Uniform Resource Locators) that specify the particular machine and pathname by which a file can be accessed, and transmitted from server to end user under Hypertext Markup Language (HTML). Codes, called tags, embedded in an HTML document associate particular words and

images in the document with URLs so that a user can access another file, which may be halfway around the word, at the press of a key or the click of a mouse.

Web pages are located by Web browsers. A web browser is software that lets a user view HTML documents and access files and software related to these documents. HTML is an application of SGML (Standard Generalized Markup Language) that uses tags to mark elements, such as text and graphics, in a document to indicate how Web browsers should display these elements to the user and should respond to user actions such as activation of a link by means of a key press or mouse click. Web browsers can provide access to documents on a network, an intranet, or the local hard drive. Web browser software is based on hyperlinks which allow users to point and click with a mouse in order to jump from document to document in whatever order they desire. Web browsers may also download and transfer files, display graphics embedded in the document, play audio and visual files associated with the document and execute small programs included by programmers in the documents. The URL specifies the protocol to be used in accessing the resource, the name of the server on which the resource resides, and, optionally, the path to a resource. The URL's are used by Web browsers to locate Internet resources.

A hyperlink is a connection between an element in a hypertext document, such as a word, phrase, symbol or image, and a different element in the document, another document, a file, or a script. A user activates the link by clicking on the linked element which is usually underlined or in a color different from the rest of the document to indicate that the element is linked. Hyperlinks are indicated in a hypertext document through tags in markup languages such as SGML and HTML.

Web browers offer an opportunity for accessing information from the internet or intranet and displaying it on the users screen. Many data structures are organized hierachially. Hierarchial refers to systems that are organized in the shape of a pyramid, with each row of objects linked to objects directly beneath it. One of the most common ways to present hierarchically organized information is in the form of a tree structure with the ability to expand or collapse any or all branches of the tree. The typical display presents a list of choices at the first level based on search criteria. The user then may select one of the items and view the choices associated with that item in a nested tree fashion. The user may further expand the view of the data selected.

Web browsers display acquired data on web pages and frames. IN HTML, a frame refers to a rectangular sections displayed by a Web browser that is a separate document from the rest of the page. In other words, the browser display is divided into separate sections, each of which is really a different web page.

The use of web pages in data display can be augmented by the use of Active Server Pages (ASP). ASP is a Web-oriented technology developed by Microsoft that is designed to enable server-side (as opposed to client-side) scripting. Activer Server Pages are text files that can contain not only text and HTML tags as in standard Web documents, but also commands written in a scripting language that can be carried out on the server. This server-sided work enables a Web author to add interactivity to a document or to customize the viewing or delivery of information to the client without consideration of the platform the client is running. All Active Server Pages are saved with an .asp extension and can be accessed like standard URL's through a Web browser, such as Microsoft Internet Explorer or Netscape Navigator. When an ASP is requested by a browser, the server carries out any script commands embedded in the page,

generates an HTML document, and sends the document back to the browser for display on the requesting (client) computer.

When using a web browser, a data file or web page can be fetched. By fetch is meant locating and loading a quantity of data from storage. Each click on a tree branch typically causes a re-fetch from the page from the server. While this method is widely used, it suffers from the following disadvantages. First, the information displayed is generally restricted to one or at most two frames. Second, the nested tree structure is cumbersome to view all choices that are available at previous level(s) without collapsing. Third, the nested tree structure is cumbersome to traverse. The user may need to collapse and/or expand several times in order to reach the desired level. Fourth, if there are too many requests for the pages due to collapsing and expanding of the tree unnecessary traffic can be generated to the server.

Therefore, what is needed beyond the prior art is a method of searching for and displaying hierarchically organized information with the ability to configure the number of search frames to be displayed, the ability to restrict depth of search levels, the ability to display search frames horizontally, vertically or in a combination of horizontally and vertically displayed frames and the ability to configure rollover direction. A further need beyond the prior art is for a method that utilizes reusable/common Active Server Page (ASP) code for search and display.

A further need beyond the prior art is for a method that can provide simultaneous viewing of more than two levels of hierarchical information. An additional need beyond the prior art is for a method that offers visual separation of data between levels by displaying them in different frame side by side. Finally, there exits a need for a method that can provide fast path access to any previously visited level.

SUMMARY OF THE INVENTION

The invention meeting the needs identified above is a method for displaying hierarchal data where the information at each level of hierarchy is displayed in a separate search frame. Several search frames are displayed side by side, either vertically, horizontally or in a combination of horizontal and vertical display, providing visual separation of data between levels. Because the items are displayed in separate frames, the items at any level can be seen without getting cluttered by data from other levels. In addition, the number of search frames can be configured. Selecting an item in a given search frame will get the data at the next level and displays it in the next frame. To traverse the hierarchy, the user would go from one frame to the next by clicking on the item of interest at each level. A toolbar frame is provided to display the cumulative selection of items. A rollover mechanism is provided to reuse the frames when the number of search frames specified is less than the depth of the search hierarchy. A Save button is provided to return the results of the search to the calling point.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1. depicts a flow chart of the overall process.

Fig. 2 depicts a data structure.

Fig. 3 depicts the display screen.

Fig. 4 depicts the display screen with data in the first display frame.

Fig. 5 depicts the display screen with data in the first and second display frame.

Fig. 6. depicts the display screen with data in the first second and third display frames.

Fig. 7 depicts the display screen and back button.

Fig. 8 depicts a further example of the display screen.

Fig. 9 depicts a further example of the display screen.

Fig. 10 depicts a further example of the display screen.

Fig. 11 depicts a further example of the display screen.

Fig. 12 depicts a further example of the display screen.

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 depicts a flow chart of the process. First the search page is invoked (**110**). By invoke is meant to call or activate a command or subroutine. The user invokes the search page by pressing the search icon on his browser display. Search criteria are entered (**112**). The search criteria to be entered are the search type, the number of display frames and the maximum depth of the search. For example, the criteria may be represented as follows:

nF = Number of display frames.

from = parameter to customizable search and query

maxL = Maximum depth for display (can be nth level)

One method of invoking the search screen is by using an Active Server Pages (ASP) specification for a Web page with a .ASP extension that utilizes ActiveX scripting. When a browser requests an

ASP page, the Web server generates a page with HTML code and sends it back to the browser. The search screen may be invoked by calling search.asp file with the following parameters:

search.asp?nF=3&maxL=6

from = type of search screen (used for identification purposes and generating queries).

maxL = max number of levels allowed.

Based on the parameters entered above, there will be three display frames and the maximum depth allowed is 6. The type of search is to look up an inventory database.

The browser program will take the parameters entered and create internal parameters (**114**). The browser determines the type of search (**116**). By search is meant the process of seeking a particular file or specific data. The browser then collects information based on the criteria (**118**). The information can be collected from a database or from the world wide web. The program checks for a database error (**120**). If an error is located, then the program prints an error message to the display screen (**122**). If there is no error, the program determines if there is a need to create a frame page (**124**). By frame page is meant a page having a toolbar, a dynamic display frame and one or more display frames to present the information acquired as a result of the search. If there is a need to create a frame page, the program creates the frame page (**126**). The ASP file initially displays the search screen with a toolbar frame, a dynamic display frame and the number of display frames selected, and then calls itself again to display data within each display frame. The first display frame will contain the results of the initial search based on the "from" parameter (e.g. look up the inventory database). The items are displayed in a list with a radio button for each item. None of the items are selected initially. As used herein, radio button means a circle with text beside it. Radio buttons are combined to show a user a fixed set of choices from which only

one can be selected. The circle is partially filled when a choice is made by clicking on the circle with a mouse. Radio buttons are used herein as only one example of a device for selecting data items. Hypertext links, check boxes, images or icons may also be used. Therefore, the term selection device shall be used herein to refer to radio buttons, hypertext links, check boxes, images, or other graphical user interfaces that allow a user to key or click on a selection and cause the selection to appear.

If there is not a need to create a frame page, then the program proceeds to the next step and determines whether the toolbar frame should be displayed (**128**). By toolbar is meant a row, column or block of on-screen button or icons. When the buttons or icons are clicked on with the mouse, macros or certain functions of the application are activated. If the toolbar frame is to be displayed (**116**) then the program displays a hypertext value in the toolbar frame and then proceed to the next step. If no toolbar frame is to be displayed, the program will proceed to the next step. Next the program determines whether the current frame is the last frame. If the current frame is not the last frame, the data is displayed in the current frame (**132**) and the program returns to step **116** and continues to cycle. If the current frame is the last frame, then the program proceeds to rollover (**134**). Rollover means that data from each search frame is shifted to the next position from its current position in the preferred direction. The preferred direction is determined by the user who selects whether the display frames are positioned from left to right, right to left in the horizontal or from top to bottom or bottom to top in the vertical. The program will ask if the search has reached the maximum depth (**118**). If maximum depth has been reached the program will disable searching (**122**). If maximum depth has not been reached, then the program will query whether the current frame is the last search frame. If the current frame is not the last search

frame, then the program will display data in the current frame. If the current frame is the last search frame, the program will perform a rollover. If rollover is exercised, then a back button will be displayed on the first search frame (**130**). Next, data will be displayed in the last frame (**132**) and the program will return to step **116**. At any time during the process, the user may click on a save button which will return all selected values to the calling point and close the window.

Figure 2 depicts data structure **160** in a data base to be searched using the above described method. Data structure **160** has first data level **162**, second data level **164**, third data level **166**, fourth data level **168** and fifth data level **170**.

Figure 3 depicts display screen **200** consisting of toolbar frame **202**, first display frame **220**, second display frame **240** and third display frame **260**. Toolbar frame **202** has save button **204** and cancel button **206**. Display screen **200** also has dynamic display frame **208**. Selecting cancel button **206** closes the search program. Selecting save button **204** returns the value(s) of all selections to the calling point and closes the window. Toolbar frame **202**, dynamic display frame **208** and the search frame(s) can be configured to any combination of horizontal and vertical frames on any side of the search screen. Data base query is invoked to obtain data for display in the display frames. Data base query can be a Structured Query Language (SQL) with parameters generated based on the selection at each level. All selected values are stored in hidden variables to avoid unnecessary query so that information can be readily displayed when the user revisits the search frame.

Fig. 4 depicts search frame **220** with toolbar frame **202** and first display frame **220**. First display frame **220** displays the first set of searchable items which in this case corresponds to first data level **162** in data structure **160** (See Fig. 2) based on the specified search type. First display

frame **200** has five data values displayed with selection devices **210**. The user can initiate further search simply by clicking one of selection devices **210** displayed in first display frame **220** corresponding to the data level for which further search is desired.

Selection of any selection device in any frame will follow these rules. Selecting a selection device in first search frame **220** will cause the next level of data for the data item corresponding to the selection device selected to be displayed in second display frame **240**. Additionally, the data item corresponding to the selection device selected will be displayed in dynamic display frame **208** as a hyperlink. Second frame **240** and third frame **260** are blank.

As will be shown below, change of a selection in any frame will change the displayed value in the dynamic display frame **208**. If the depth of the level is greater than the level of the last search frame, then any selection in the last search frame will initiate a rollover effect. By rollover effect is meant that data will be shifted for display in the search frames of the preferred direction.

Fig. 5 shows dynamic display section **208** showing the cumulative selections from each search frame. Every value displayed in dynamic display frame **208** is a hyperlink. Clicking on any value will dynamically change selections in each search frame to display the appropriate items. Dynamic display frame **208** provides a fast path to the required level. The user may take a fast path to the required level by clicking on the appropriate hyperlink in the dynamic display frame. An additional means for navigating backward is by using a 'back' button which will be discussed below. Display frame **220** displays the name of the searching category and the items from that category available for selection. First display frame **220** displays data items from first data level **162** of data structure **160**. Second display frame **240** displays data items from second data level **164** of data structure **160**.

Clicking on any of the selection devices in first display frame **220** calls the search.ASP file again, with additional information including current level and current item selected. The ASP checks for the parameters, fetches data associated with the selected item and displays them in the second display frame. None of the items in second display frame **240** are selected. Third display frame **260** will be blank. The value of the selected item in first display frame **220** is displayed in dynamic display frame **208**. (e.g. SOFTWARE). When additional values are displayed in dynamic display frame **208** they will be displayed in hierarchical format.

Referring to Fig. 6, clicking on any of the selection devices in second display frame **220** calls the search.ASP file again, with additional information including current level and current item selected. The ASP checks for the parameters, fetches data associated with the selected and displays them in third display frame **260**. None of the items in third display frame **260** are selected. The value of the selected item in second display frame **240** is displayed in the toolbar frame in a hierarchal format.

(E.g. SOFTWARE => NAMESERVER =>).

A Rollover mechanism is implemented to replace data of the hierarchy so only a preferred number of levels will be shown. The Rollover mechanism can be configured to shift data in all search frames in any direction. Based on the passed parameters, search type, number of displaying frame, depth of search, current level, and current frame, selecting an item in the search frame will populate searched information in the next search frame. Moreover, the value of the selected item will be added to previously selected value(s) in the dynamic display frame. Forward rollover occurs automatically by clicking on an item in the last search frame. This applies only if there is at least one more level beyond the level of last search frame.

When the rollover effect takes place, Back button **212** will be displayed in first frame to enable the user to return to the previous level in the search hierarchy. The level prior to the first search frame will be indicated on back button **212**. Previous selected values in the hierarchy will be checked as the user maneuvers back and forth between search frames. Save button **204** in toolbar frame **202** returns the value(s) of all selections to the calling point. Database query is invoked to obtain the next set of search criteria. The result is then formatted into a selection list with selection devices. All selected values are stored in a hidden variable to avoid unnecessary query so that information can be readily displayed when the user revisits the search frame/page.

Referring to Fig. 7, clicking on any of the selection devices in third display frame **260** calls the search.ASP file again, with additional information including current level and current item selected. The ASP checks for the parameters and fetches data associated with the selected item. However, because it is the last display frame, a rollover to the left side will be effected. Therefore, the fetched information will be displayed in third display frame **260**. The data in third display frame **260** will be rolled to second display frame **240**, and what was in second display frame **240** will be rolled to first display frame **220**. What was in first display frame **220** will not be visible. None of the items in third display frame **260** are selected. Because of the rollover effect, Back button **212** is displayed in first display frame **220** to allow the user to return to the previous level. The level number is indicated on back button **212**. Back button **212** is provided in first display frame **220** for backward rollover when data level acquired exceeds the number of display frames selected. The level prior to first search frame is indicated on the back button. The value of the selected item in third display frame **260** is displayed in dynamic display frame **208** in a hierarchal format.

A user may traverse the display frames in any of three ways. First, the user may use the selection device next to the item to be selected (or hyperlink, check box, image or icon) to call that item to be displayed. Second, the user may use the hyperlink in the dynamic display section which shall be referred to as a fast path because clicking on the hyperlink in the dynamic display section brings that item clicked on into first display frame **220**. Finally, the user may click on back button **212**. As used herein, traverse means to go back and forth.

(e.g. SOFTWARE=>NAMESERVER=>Module4=>)

Referring to fig. 8, clicking on any of the selection devices in third display frame **260** will trigger the rollover effect again and back button **212** will display "Back to 2" . The value of the selected item in third display frame **260** is displayed in dynamic display frame **208** in a hierarchal format. (e.g. SOFTWARE=>NAMESERVER=>Module4=>Item4-1)

Referring to Fig. 9, clicking on any selection devices **210** in second display frame **240** will not trigger the rollover effect. It will only fetch information associated with the item corresponding to the selected selection device **210** and display that data in third display frame **260**. The value of the selected item in second display frame **240** is displayed in dynamic display frame **208** in a hierarchical format. (e.g. SOFTWARE = >NAMESERVER => Module4 = >Item4-3 =>)

Referring to fig. 10, clicking on any selection device **210** in first display frame **220** will populate information associated with the selected item in second display frame **240**. Third display frame **260** will be blank. The value of the selected item in first display frame **220** is displayed in dynamic display frame **208** in a hierarchal format. (e.g. SOFTWARE =>NAMESERVER=> Module2=>)

Referring to fig. 11. Clicking on any selection device **210** in second display frame **240** populates information associated with the selected item in third display frame **260**. First display frame **220** does not change. The value of the selected item in second display frame **240** is displayed in the dynamic display frame **208** in a hierarchal format. (e.g. SOFTWARE => NAMESERVER => Module2 => Item2-1=>)

Referring to fig. 12, clicking on back button **212** takes the user back to the previous level in the hierarchy. First display frame **220** will contain data from the previous level. Second display frames **240** and third display frame **260** will be blank. The items selected at all previous levels are restored and shown as selected. Dynamic display frame **208** will reflect the change. (SOFTWARE =>) Clicking on save button **204** in toolbar frame **202** will close the search page and return all selected value(s) to the calling point.

The advantages provided by the present invention should be apparent in light of the detailed description provided above. The description of the present invention has been presented for purposes of illustration and description, but is not limited to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in order to best explain the principles of the invention the practical application and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.



CLAIMS

What is claimed:

1. A method for search and display of hierarchically organized information using graphical user interfaces comprising the steps of:

invoking a search screen;

selecting the number of display frames; and

selecting the maximum depth level for display.

2. The method of claim 1 further comprising selecting an item from a display frame.

3. The method of claim 1 further comprising the step of traversing said display frames by choosing one or more selection devices.

4. The method of claim 1 further comprising the step of rollover.

5. The method of claim 1 further comprising the step of traversing display screens by a fast path.

* C L M S *

6. The method of claim 1 further comprising selecting whether the display frames are positioned from left to right, right to left in the horizontal or from top to bottom or bottom to top in the vertical.

7. The method of claim 1 further comprising traversing display screens by a back button.

8. A programmable apparatus for search and display of hierarchially organized information using graphical user interfaces comprising,

programmable hardware comprising;

at least one computer;

at least one network;

a program installed on said computer;

wherein responsive to said program, data is acquired from said network and displayed in one or more display screens.

9. The program of claim 8 further comprising a plurality of selection devices wherein clicking on a selection device next to a first data level in a first display frame will cause a second data level to be displayed in a second display frame.

10. The program of claim 8 further comprising a rollover mechanism.

* C L M S *

11. The program of claim 8 further comprising a fast path.

12. The program of claim 8 further comprising a back button.

13. The program of claim 8 further comprising user selection of whether the display frames are positioned from left to right, right to left in the horizontal or from top to bottom or bottom to top in the vertical.

14. The program of claim 8 further comprising a cumulative display of hyperlinks in a dynamic display frame.

15. A computer readable memory for causing a computer to search and display hierarchially organized information using graphical user interfaces comprising:

a computer readable storage medium;

a computer program stored in said storage medium;

the storage medium, so configured by said computer program, responsive to a request from at said computer, causes the computer to query a user for search parameters; and

responsive to said parameters, acquires data for display.

16. The computer program of claim 15 further comprising a plurality of selection devices.

17. The computer program of claim 15 further comprising a rollover mechanism.

* C L M S *

18. The computer program of claim 15 further comprising a back button.

19. The computer program of claim 15 further comprising a fast path.

20. The computer program of claim 15 further comprising a cumulative display of hyperlinks in a dynamic display frame.

21. The computer program of claim 15 further comprising user selection of whether the display frames are positioned from left to right, right to left in the horizontal or from top to bottom or bottom to top in the vertical.

22. A computer implemented process to accomplish search and display of hierarchically organized information using graphical user interfaces comprising:

using a computer, performing the following series of steps:

powering the computer;

connecting said computer to at least one network;

providing search criteria to a program in said computer;

acquiring data on one or more data levels responsive to said criteria;

displaying said data levels in one or more display frames in a frame page;

selecting whether the display frames are positioned from left to right, right to left in the horizontal or from top to bottom or bottom to top in the vertical;

displaying a cumulative display of hyperlinks in a dynamic display frame for traversing display screens by a fast path;

traversing said display frames by one or more selection devices; and

traversing said display frames by a back button

23. A method for search and display of hierarchically organized information using graphical user interfaces, the method comprising the computer implemented steps of:

executing instructions from a computer first memory to invoke a search screen;

responsive to a request from said search screen, inputting search criteria;

responsive to said search criteria, acquiring one or more data levels;

selecting whether the display frames are positioned from left to right, right to left in the horizontal or from top to bottom or bottom to top in the vertical;

displaying the one or more data levels in adjacent display frames;

traversing said data levels by clicking on one or more selection devices; and

changing said display frames in response to a rollover mechanism.