US006859909B1

(12) **United States Patent**
Lerner et al.

(10) **Patent No.: US 6,859,909 B1**
(45) **Date of Patent: Feb. 22, 2005**

(54) **SYSTEM AND METHOD FOR ANNOTATING WEB-BASED DOCUMENTS**

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(73) Assignee: **Microsoft Corporation**, Redmond, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/521,022**

(22) Filed: **Mar. 7, 2000**

(51) **Int. Cl.**[7] **G06F 15/00**

(52) **U.S. Cl.** **715/512**; 715/530; 345/440; 709/203

(58) **Field of Search** 715/512, 501.1, 715/530, 526, 500; 345/440; 709/203, 217

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(List continued on next page.)

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Assistant Examiner—Maikhanh Nguyen
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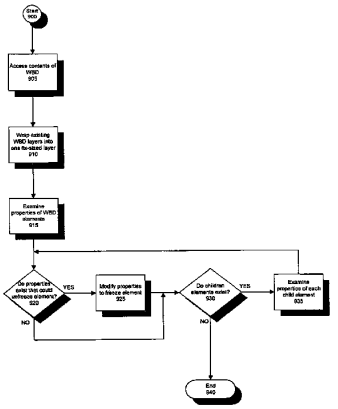
(57) **ABSTRACT**

The present invention allows computer users to integrate any annotation, including ink, highlighter, text-based notes and audio, directly into a Web-based document (WBD) displayed by a Web browser. This integration enables others to view the personalized annotated WBD, which retains its original active links and properties, over the Internet without the need for specialized software. Annotations are integrated into WBDs by freezing the WBD, overlaying an image file containing the annotations onto the WBD, and enabling browser events to pass through the image layer. Annotations may also be integrated into WBDs by using component object technology. The present invention collects and organizes annotated WBDs, and provides users with an intuitive Web-based interface for accessing, viewing and searching the annotated WBDs. Users may annotate blank WBDs, effectively converting their Web browsers into online notebooks/ scrapbooks. The present invention also provides users with many novel interface techniques, such as dog-ears and its associated navigation tools, splitting pages, turning pages, selecting and copying various portions of a WBD (including shaking out a copy), and marking menus suited for right-handed or left-handed users.

6 Claims, 23 Drawing Sheets



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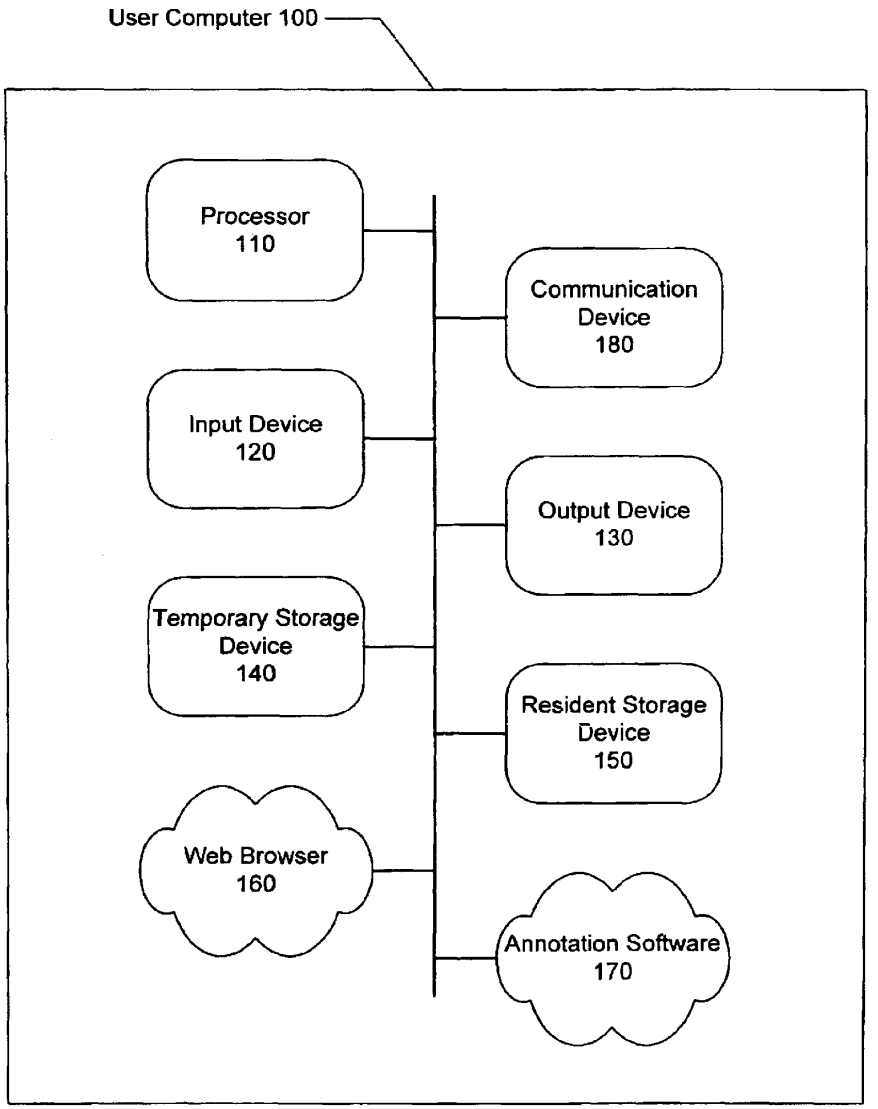
User Computer 100
Processor
110
Input Device
120
Temporary Storage
Device
140
Web Browser
160
Communication
Device
180
Output Device
130
Resident Storage
Device
150
Annotation Software
170

FIG. 1

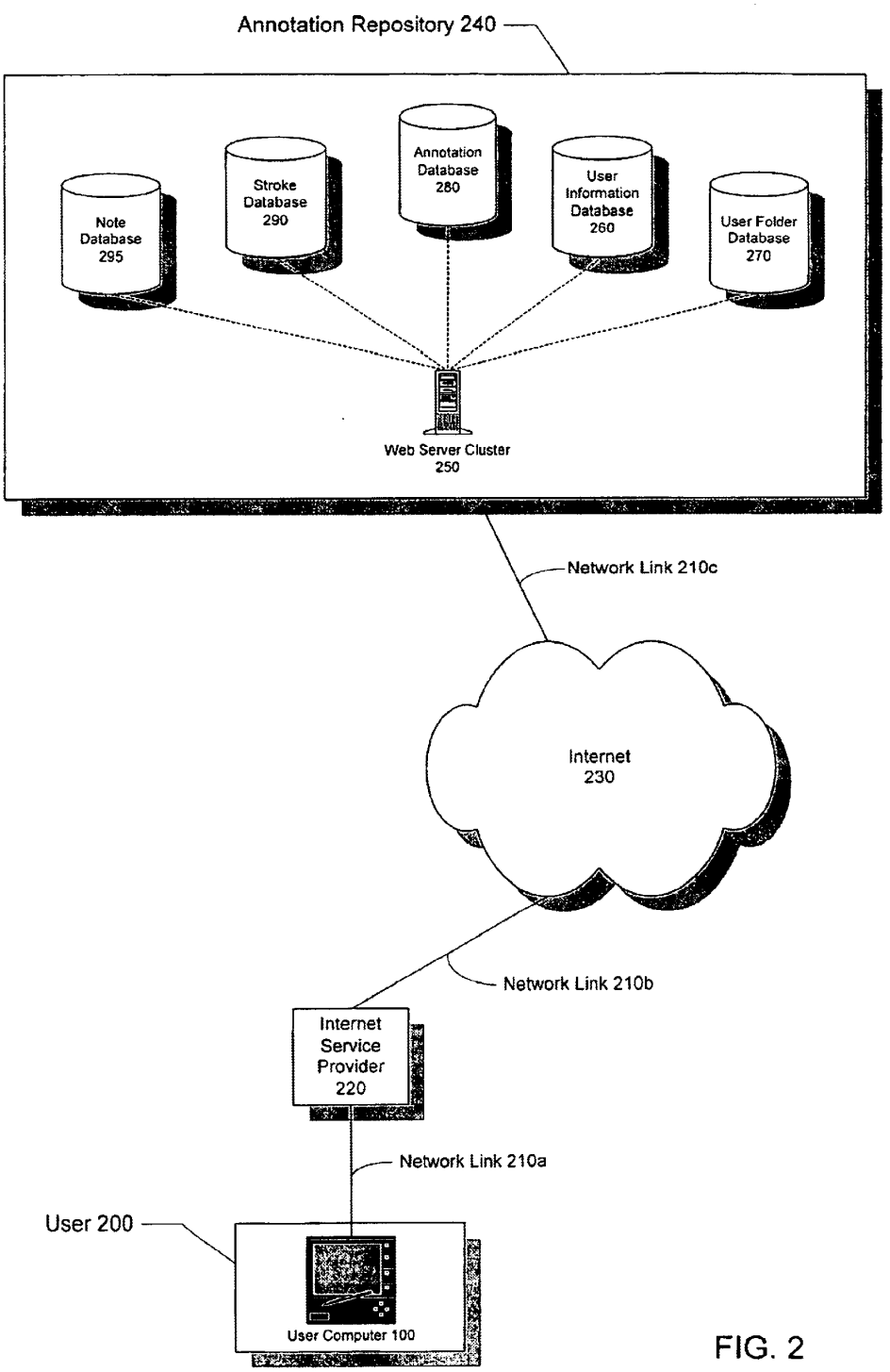
Annotation Repository 240
Note Database 295
Stroke Database 290
Annotation Database 280
User Information Database 260
User Folder Database 270
Web Server Cluster 250
Network Link 210c
Internet 230
Network Link 210b
Internet Service Provider 220
Network Link 210a
User 200
User Computer 100

FIG. 2

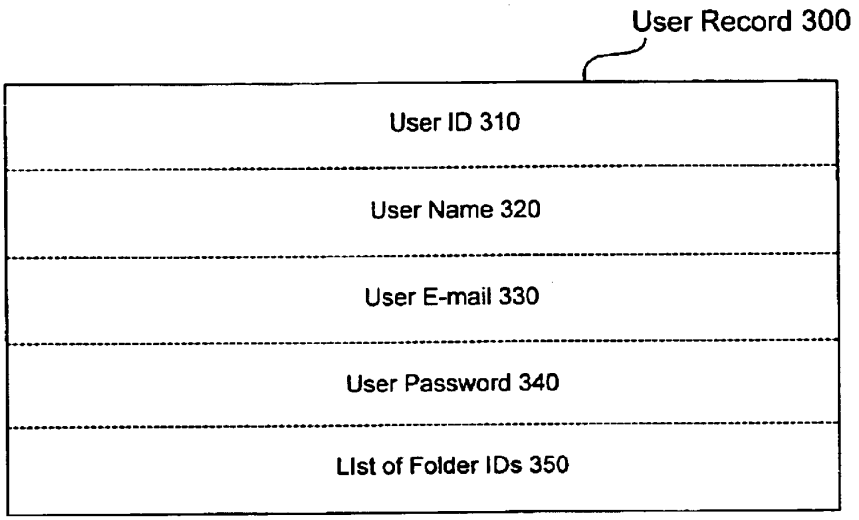
User Record 300
User ID 310
User Name 320
User E-mail 330
User Password 340
List of Folder IDs 350

FIG. 3

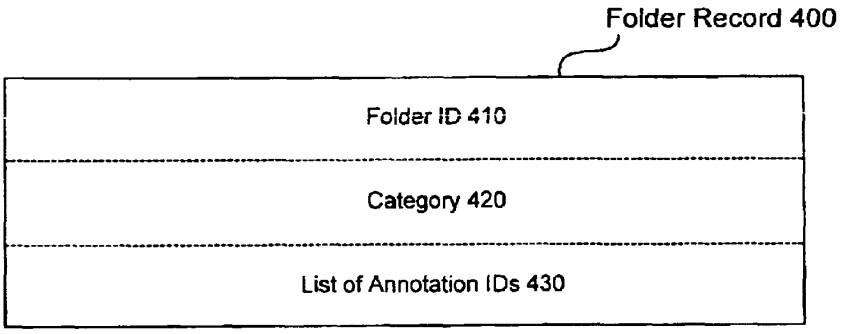
Folder Record 400
Folder ID 410
Category 420
List of Annotation IDs 430

FIG. 4

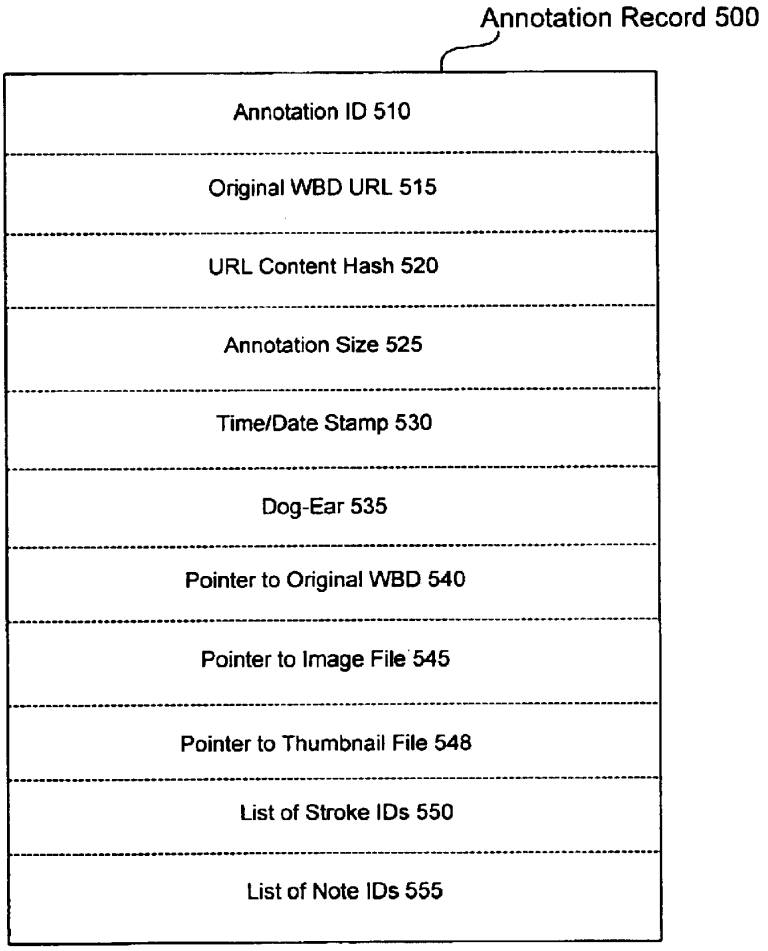
Annotation Record 500
Annotation ID 510
Original WBD URL 515
URL Content Hash 520
Annotation Size 525
Time/Date Stamp 530
Dog-Ear 535
Pointer to Original WBD 540
Pointer to Image File 545
Pointer to Thumbnail File 548
List of Stroke IDs 550
List of Note IDs 555

FIG. 5

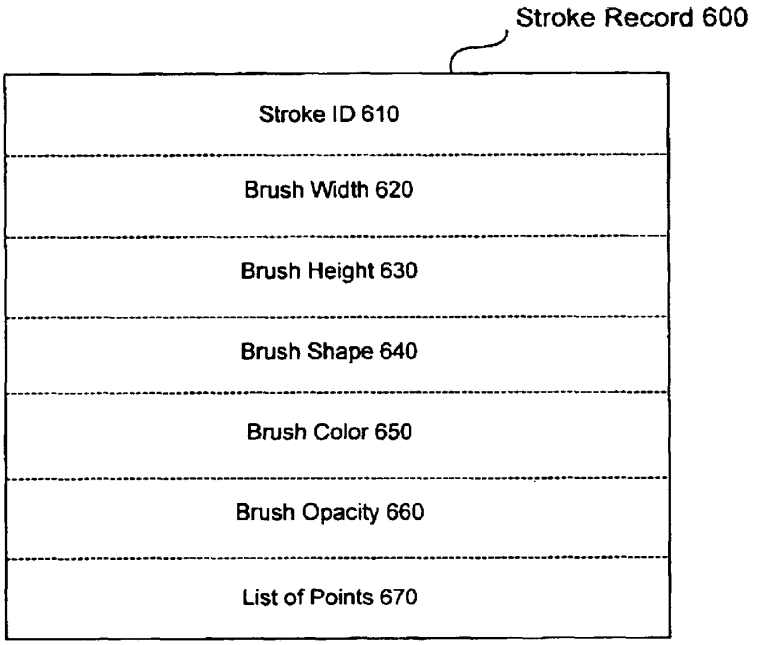
Stroke Record 600
Stroke ID 610
Brush Width 620
Brush Height 630
Brush Shape 640
Brush Color 650
Brush Opacity 660
List of Points 670

FIG. 6

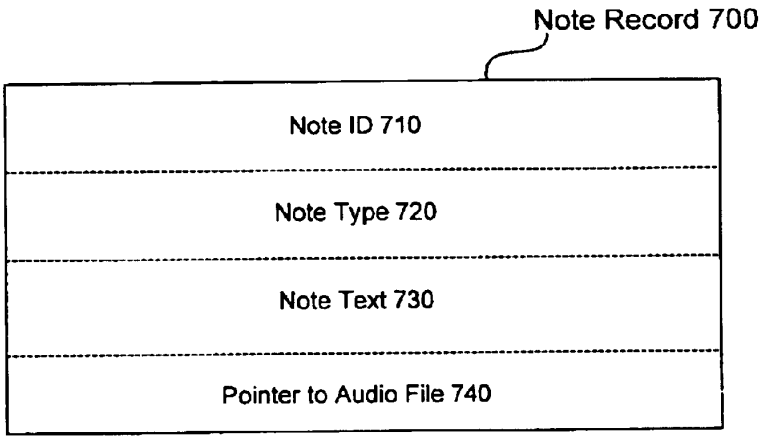
Note Record 700
Note ID 710
Note Type 720
Note Text 730
Pointer to Audio File 740

FIG. 7

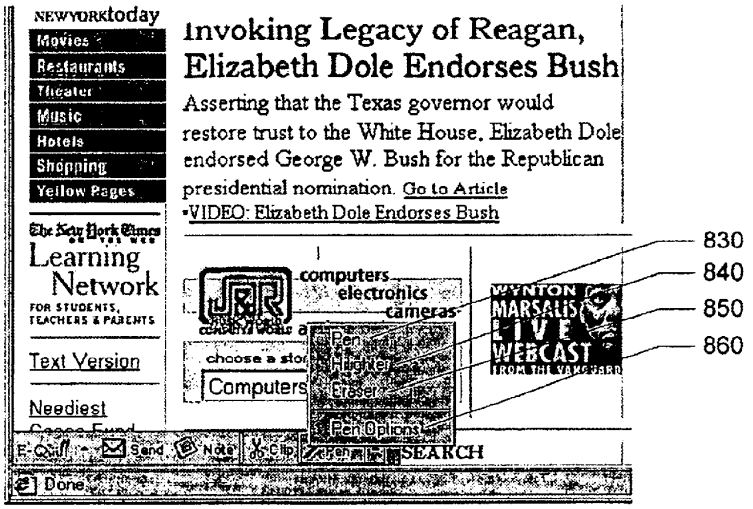
NEWYORKtoday
Movies
Restaurants
Theater
Music
Hotels
Shopping
Yellow Pages
Invoking Legacy of Reagan, Elizabeth Dole Endorses Bush
Asserting that the Texas governor would restore trust to the White House, Elizabeth Dole endorsed George W. Bush for the Republican presidential nomination. Go to Article
VIDEO: Elizabeth Dole Endorses Bush
Learning Network
FOR STUDENTS, TEACHERS & PARENTS
Text Version
Neediest
computers
electronics
cameras
Computers
Pen
Highlighter
Eraser
Pen Options
SEARCH
Done
830
840
850
860

FIG. 8A

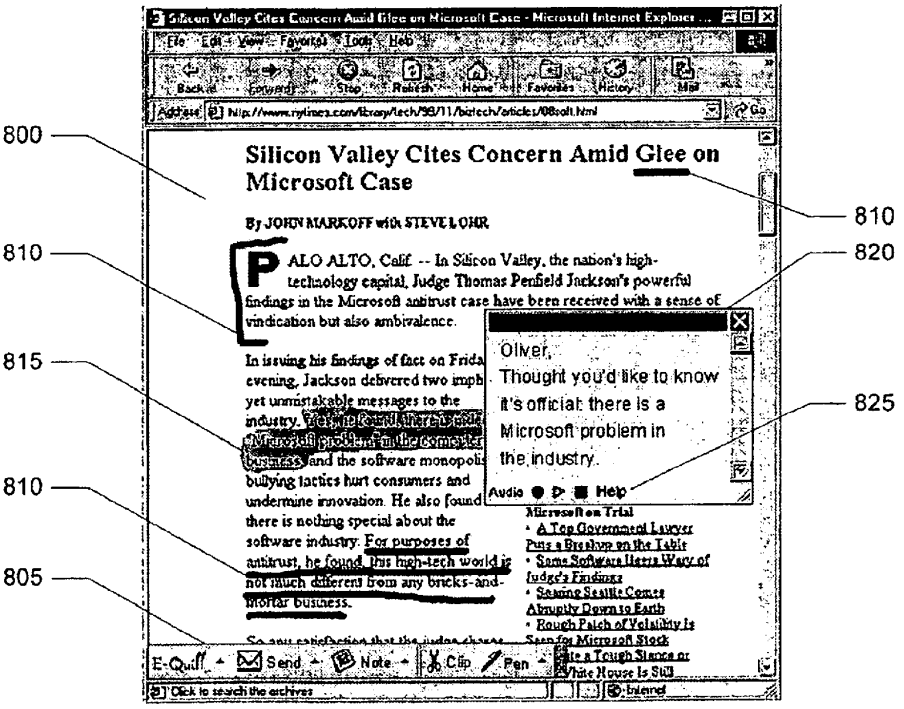
Silicon Valley Cites Concern Amid Glee on Microsoft Case
By JOHN MARKOFF with STEVE LOHR
PALO ALTO, Calif. -- In Silicon Valley, the nation's high-technology capital, Judge Thomas Penfield Jackson's powerful findings in the Microsoft antitrust case have been received with a sense of vindication but also ambivalence.
Oliver,
Thought you'd like to know it's official: there is a Microsoft problem in the industry.
Audio
Help
800
810
815
820
825
805

FIG. 8

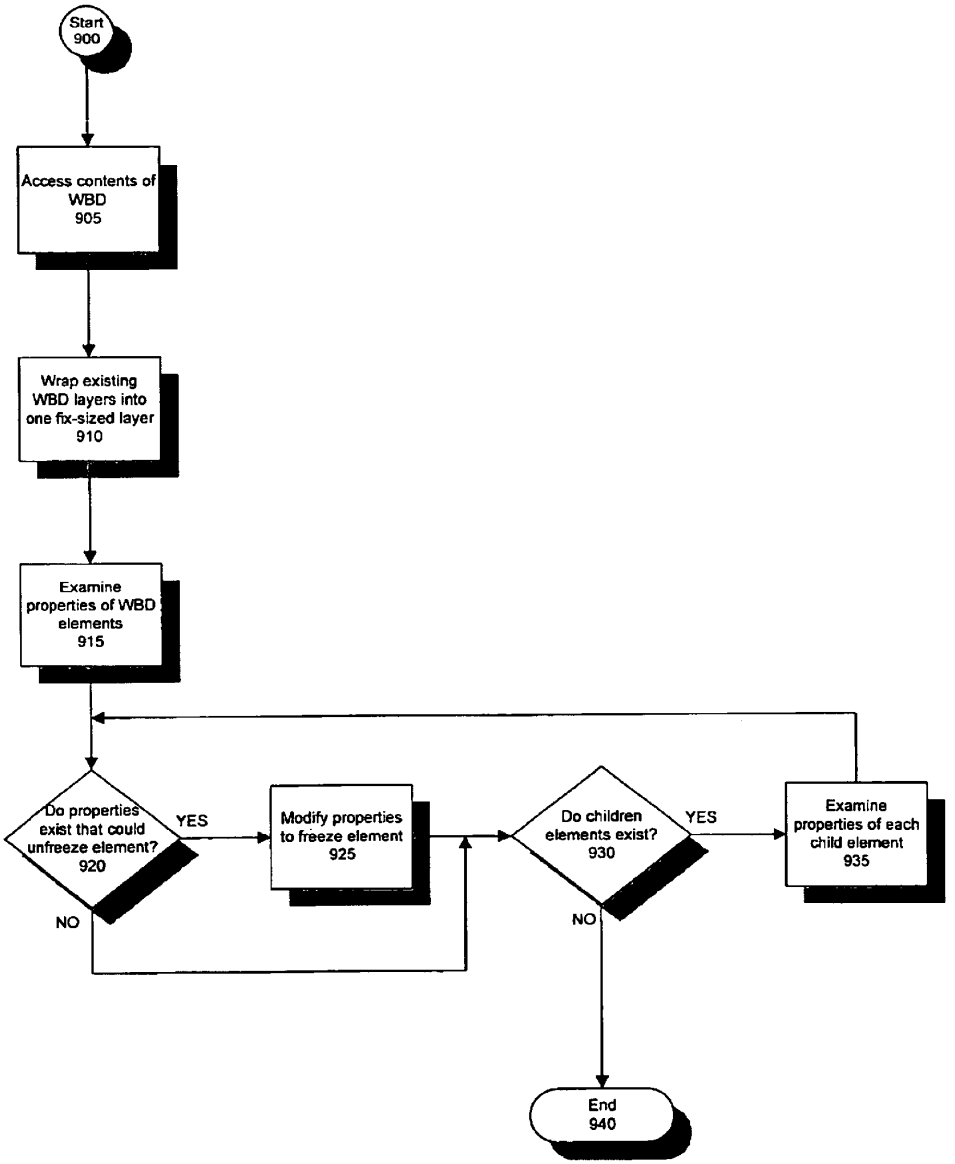
Start
900
Access contents of WBD
905
Wrap existing WBD layers into one fix-sized layer
910
Examine properties of WBD elements
915
Do properties exist that could unfreeze element?
920
YES
NO
Modify properties to freeze element
925
Do children elements exist?
930
YES
NO
Examine properties of each child element
935
End
940

FIG. 9

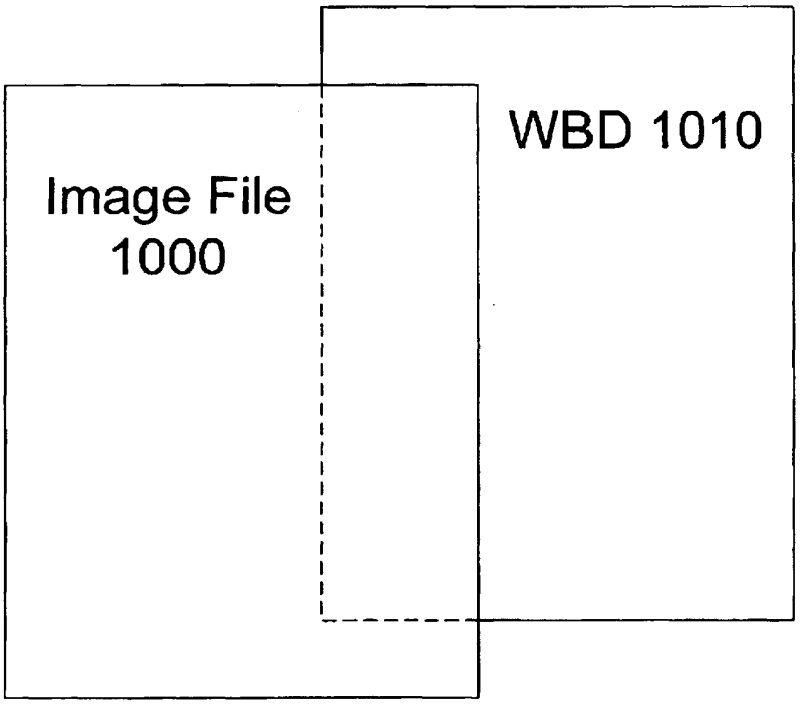

FIG. 10

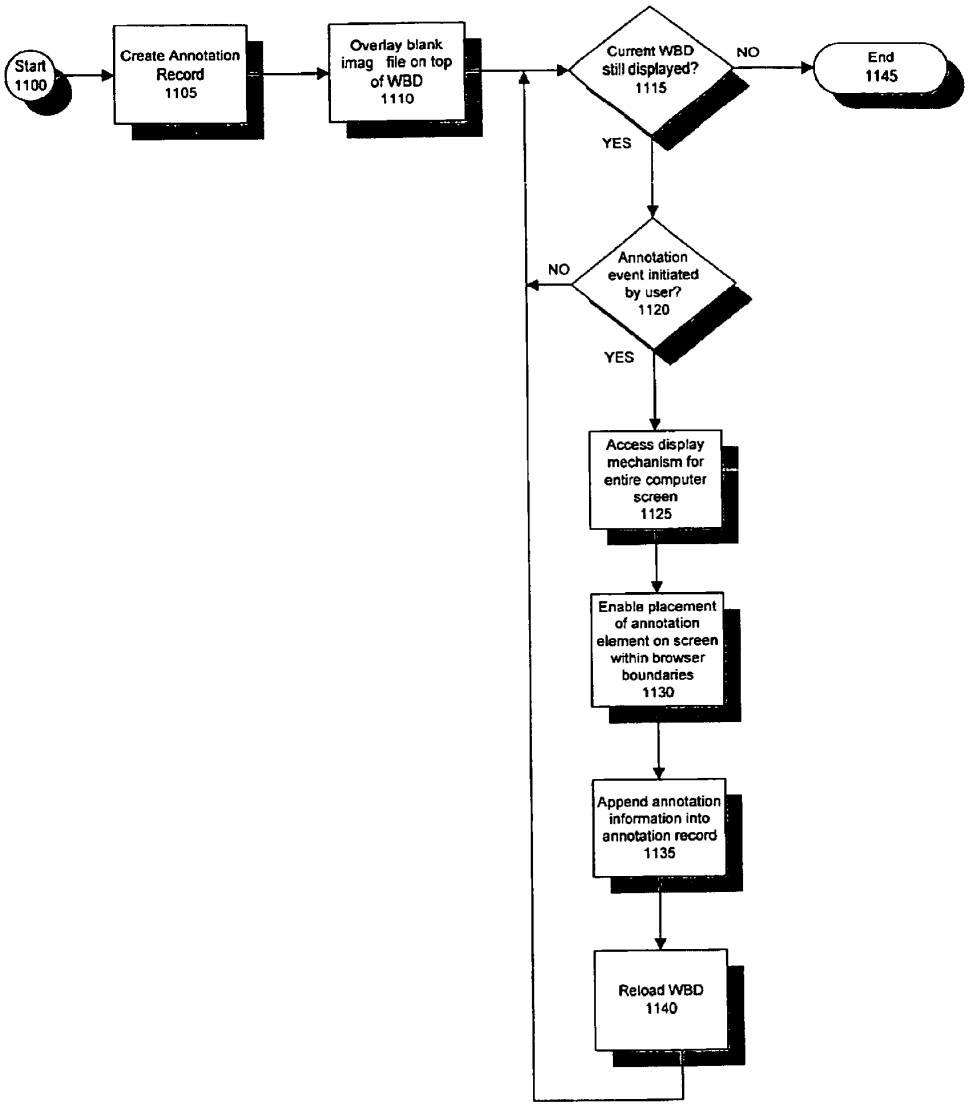
Start
1100
Create Annotation Record
1105
Overlay blank imag file on top of WBD
1110
Current WBD still displayed?
1115
NO
End
1145
YES
Annotation event initiated by user?
1120
NO
YES
Access display mechanism for entire computer screen
1125
Enable placement of annotation element on screen within browser boundaries
1130
Append annotation information into annotation record
1135
Reload WBD
1140

FIG. 11

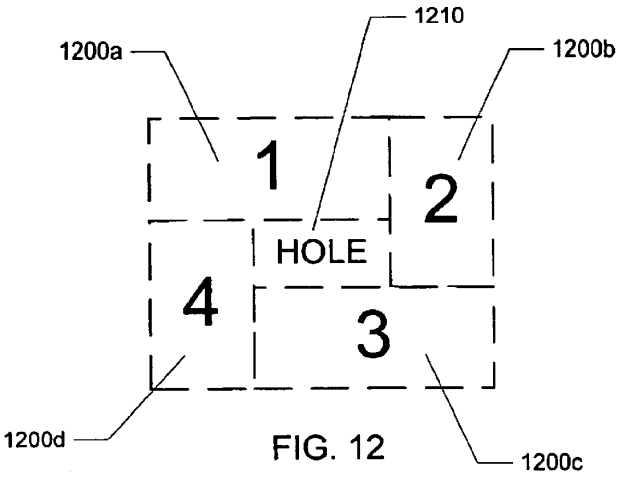
1210
1200a
1200b
1
2
HOLE
4
3
1200d
1200c

FIG. 12

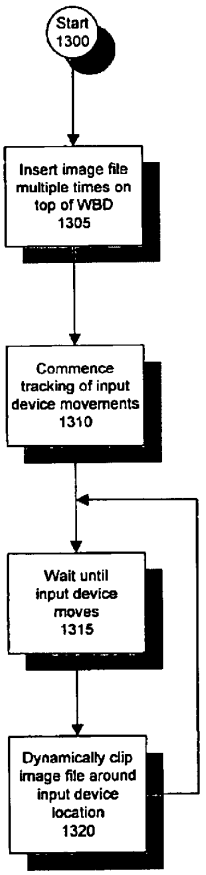
Start
1300
Insert image file multiple times on top of WBD
1305
Commence tracking of input device movements
1310
Wait until input device moves
1315
Dynamically clip image file around input device location
1320

FIG. 13

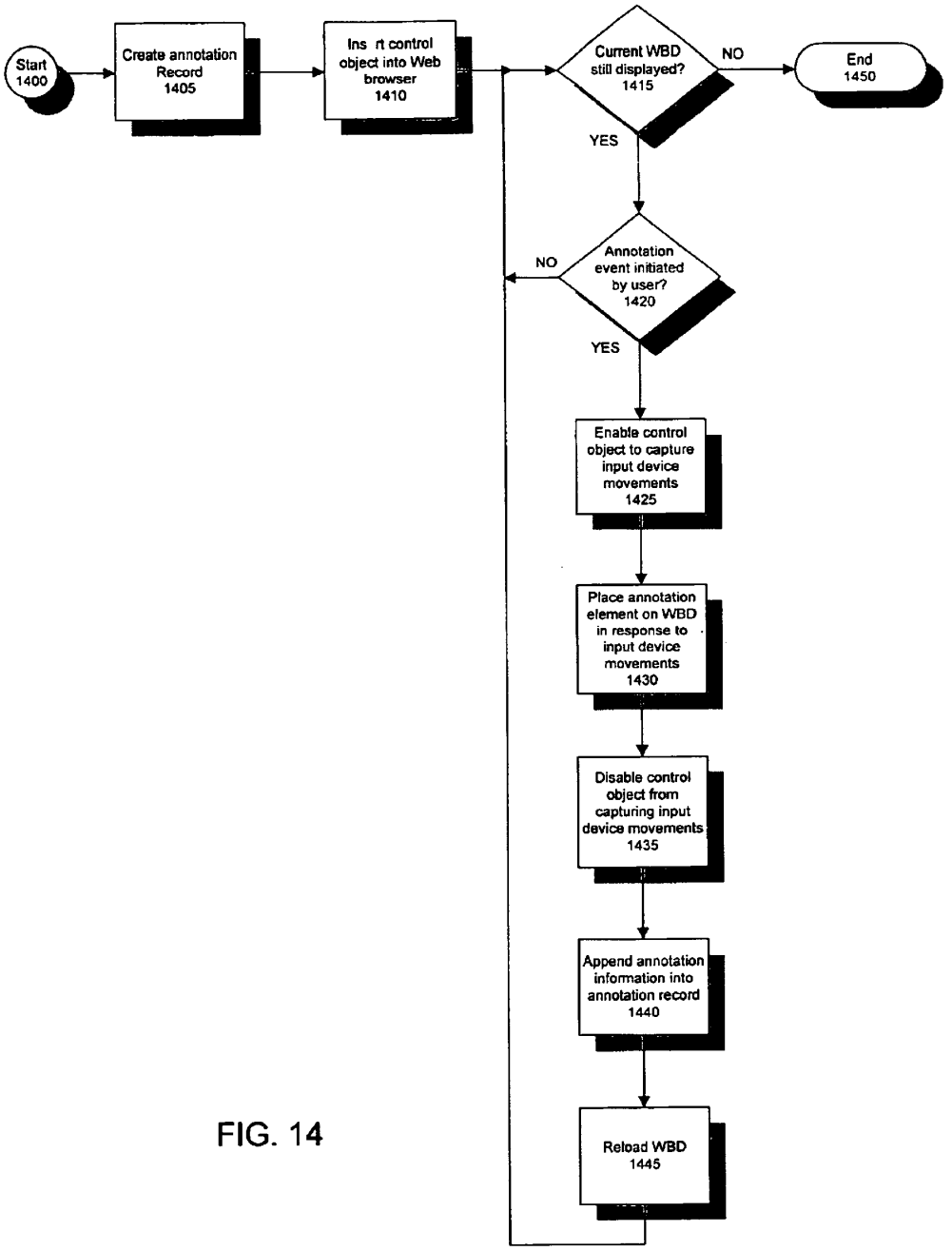
Start
1400
Create annotation Record
1405
Ins rt control object into Web browser
1410
Current WBD still displayed?
1415
NO
End
1450
YES
Annotation event initiated by user?
1420
NO
YES
Enable control object to capture input device movements
1425
Place annotation element on WBD in response to input device movements
1430
Disable control object from capturing input device movements
1435
Append annotation information into annotation record
1440
Reload WBD
1445

FIG. 14

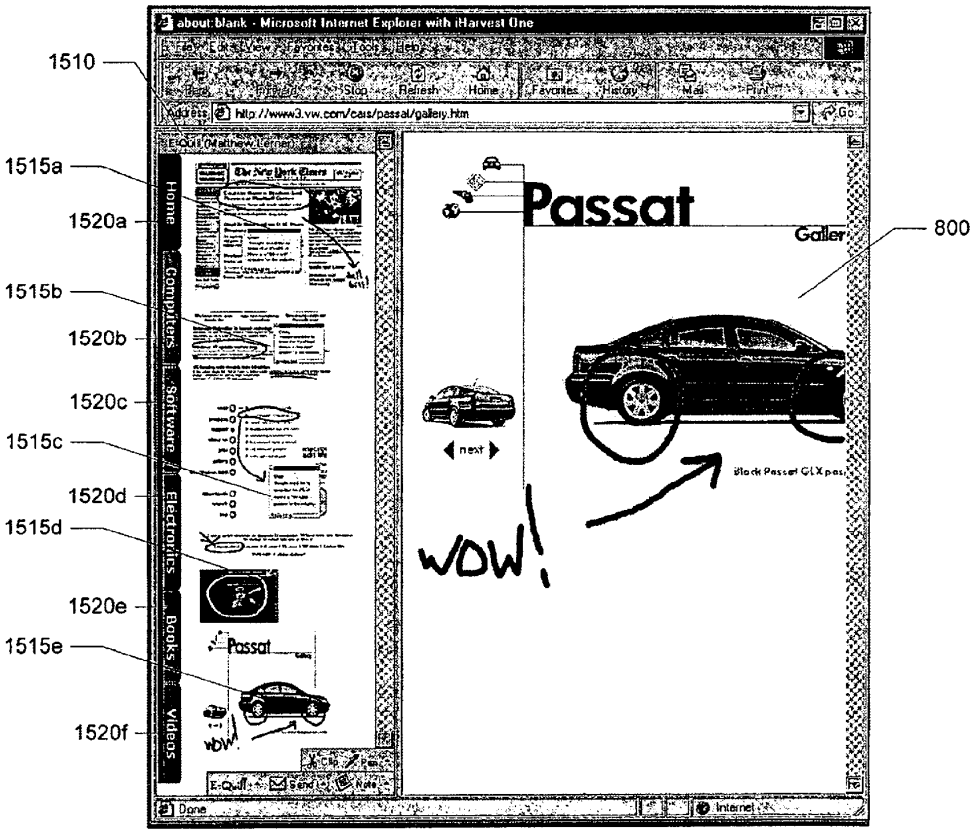
1510
1515a
1520a
1515b
1520b
1520c
1515c
1520d
1515d
1520e
1515e
1520f
800
about:blank - Microsoft Internet Explorer with iHarvest One
http://www3.vw.com/cars/passat/gallery.htm
Home
Computers
Software
Electronics
Books
Videos
Passat
Passat
next
WOW!

FIG. 15

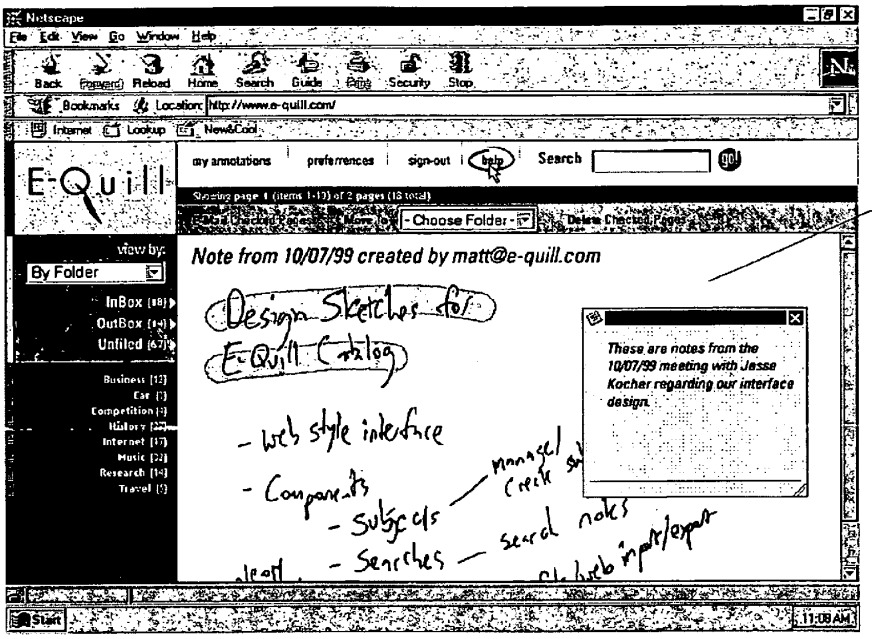
Netscape
File Edit View Go Window Help
Back Forward Reload Home Search Guide Print Security Stop
Bookmarks Location: http://www.e-quill.com/
Internet Lookup New&Cool
E-Quill
my annotations
preferences
sign-out
help
Search
Showing page 1 (items 1-11) of 2 pages (13 total)
- Choose Folder -
Delete Checked Pages
view by:
By Folder
InBox [88]
OutBox [14]
Unfiled [67]
Business [12]
Car [1]
Competition [3]
History [22]
Internet [17]
Music [22]
Research [14]
Travel [1]
Note from 10/07/99 created by matt@e-quill.com
These are notes from the 10/07/99 meeting with Jesse Kocher regarding our interface design.
Start
11:09 AM
800

FIG. 15A

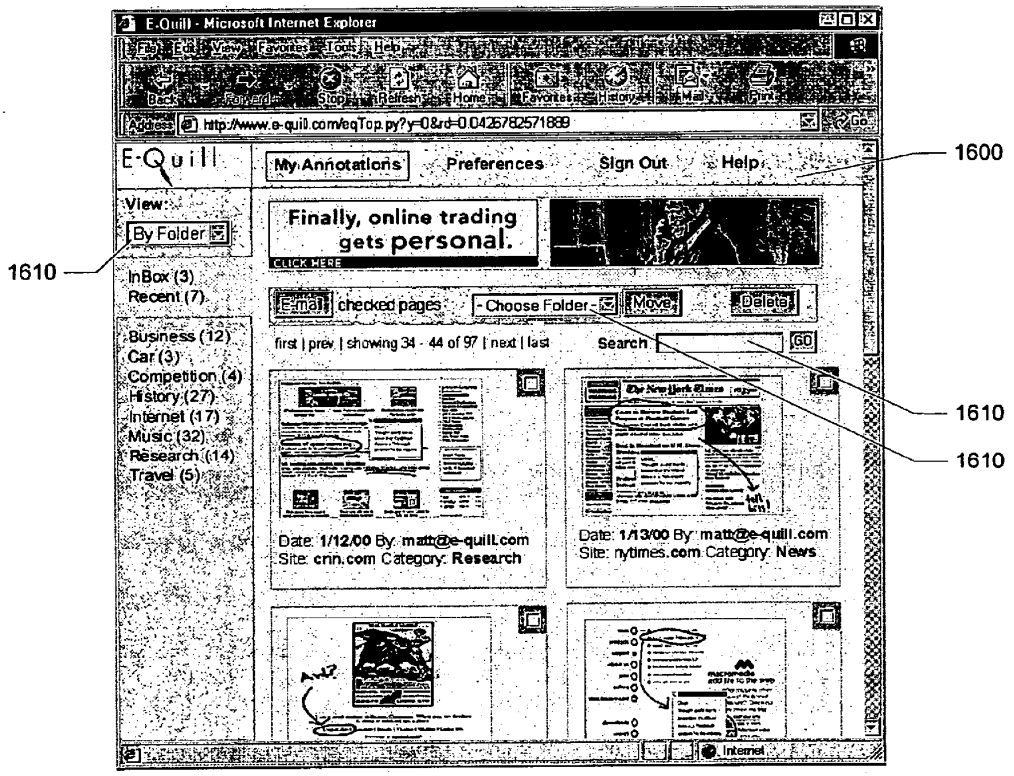
E-Quill - Microsoft Internet Explorer
E-Quill
My Annotations
Preferences
Sign Out
Help
1600
View:
By Folder
1610
InBox (3)
Recent (7)
Business (12)
Car (3)
Competition (4)
History (27)
Internet (17)
Music (32)
Research (14)
Travel (5)
Finally, online trading gets personal.
E-mail
checked pages
- Choose Folder -
Move
Delete
first | prev | showing 34 - 44 of 97 | next | last
Search
GO
1610
1610
Date: 1/12/00 By: matt@e-quill.com
Site: cnn.com Category: Research
Date: 1/13/00 By: matt@e-quill.com
Site: nytimes.com Category: News

FIG. 16

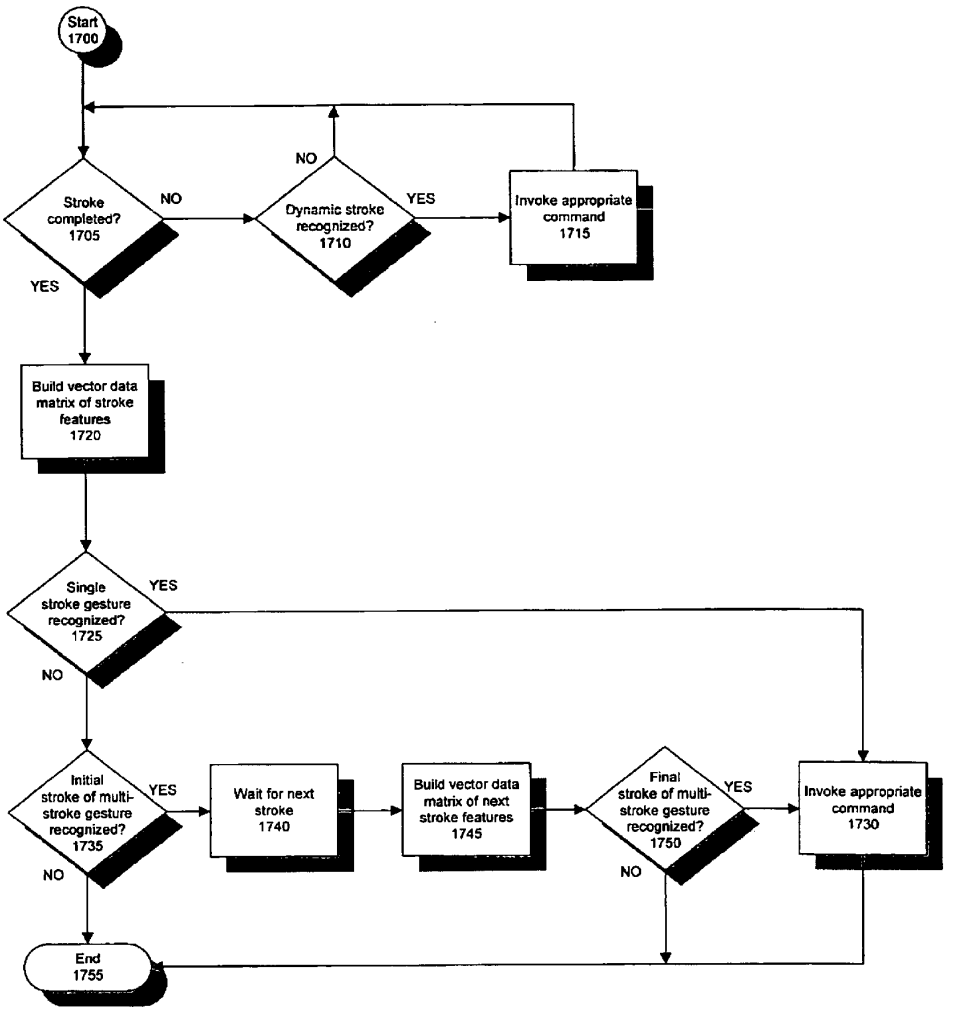
Start
1700
Stroke completed?
1705
NO
YES
Dynamic stroke recognized?
1710
NO
YES
Invoke appropriate command
1715
Build vector data matrix of stroke features
1720
Single stroke gesture recognized?
1725
YES
NO
Initial stroke of multi-stroke gesture recognized?
1735
YES
NO
Wait for next stroke
1740
Build vector data matrix of next stroke features
1745
Final stroke of multi-stroke gesture recognized?
1750
YES
NO
Invoke appropriate command
1730
End
1755

FIG. 17

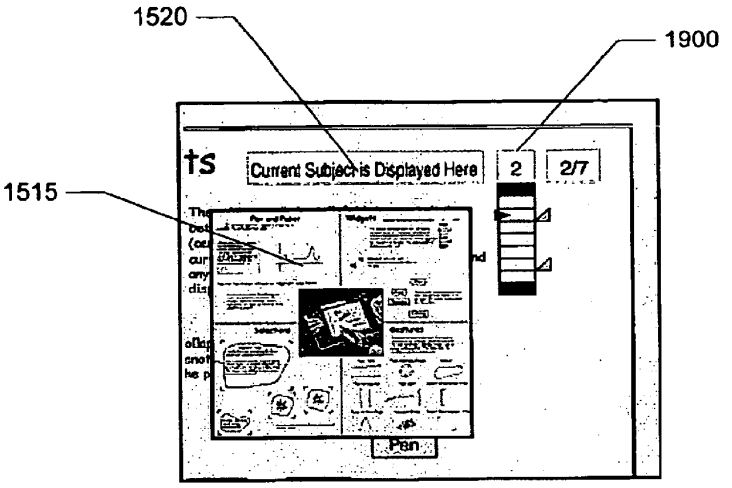
1520
1900
1515
Current Subject is Displayed Here
2
2/7
Pan

FIG. 19

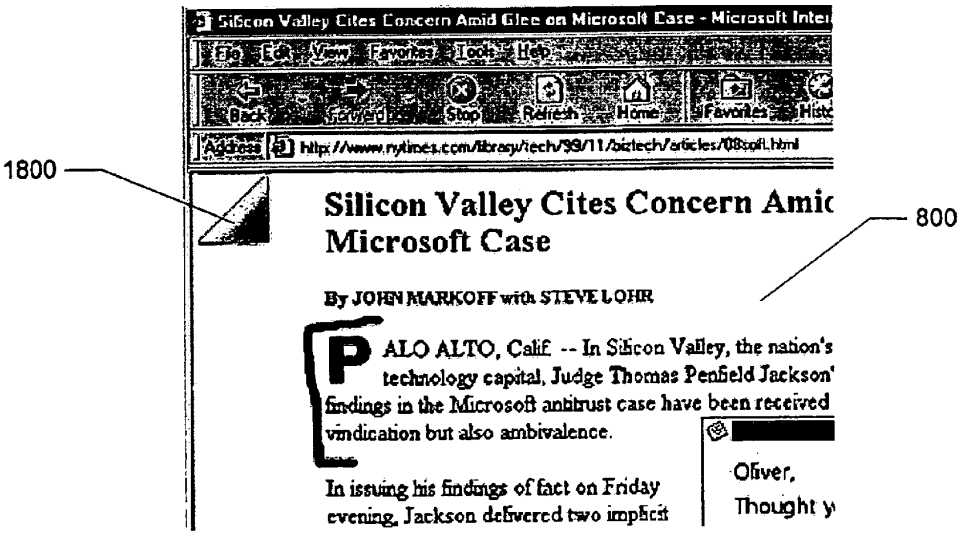
1800
800
Silicon Valley Cites Concern Amid Glee on Microsoft Case - Microsoft Inter
Back
Stop
Refresh
Home
Favorites
Address
Silicon Valley Cites Concern Amic
Microsoft Case
By JOHN MARKOFF with STEVE LOHR
PALO ALTO, Calif. -- In Silicon Valley, the nation's
technology capital, Judge Thomas Penfield Jackson'
findings in the Microsoft antitrust case have been received
vindication but also ambivalence.
In issuing his findings of fact on Friday
evening, Jackson delivered two implicit
Oliver,
Thought y

FIG. 18

Flip to Dog-ear

FIG. 21

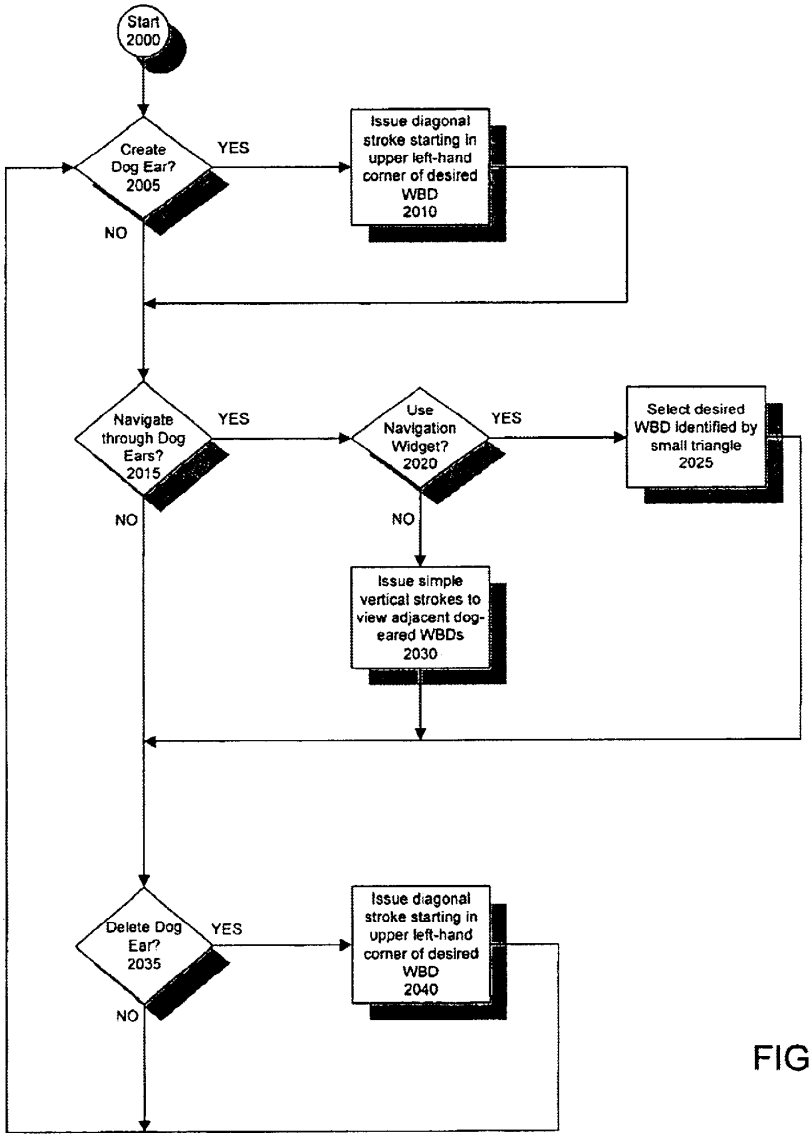
Start
2000
Create Dog Ear?
2005
YES
NO
Issue diagonal stroke starting in upper left-hand corner of desired WBD
2010
Navigate through Dog Ears?
2015
YES
NO
Use Navigation Widget?
2020
YES
NO
Select desired WBD identified by small triangle
2025
Issue simple vertical strokes to view adjacent dog-eared WBDs
2030
Delete Dog Ear?
2035
YES
NO
Issue diagonal stroke starting in upper left-hand corner of desired WBD
2040

FIG. 20

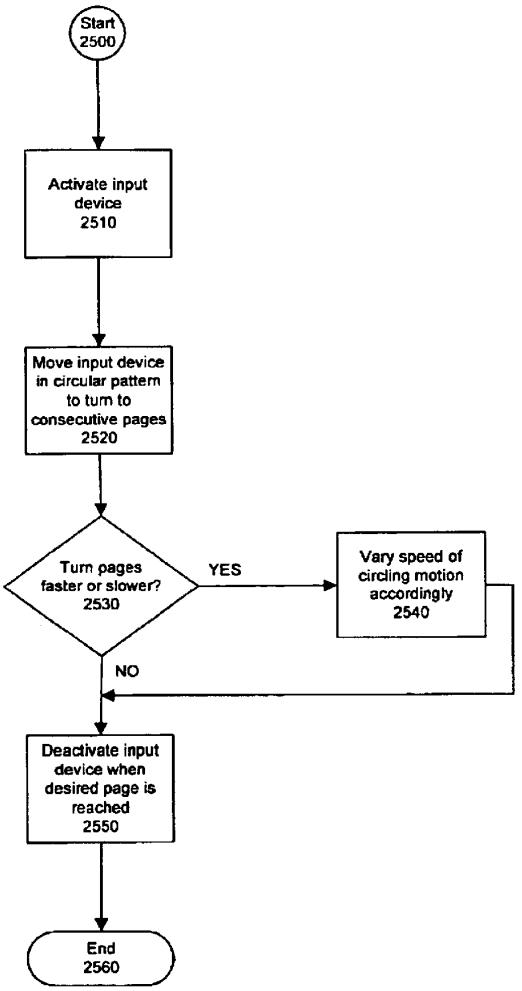

FIG. 25

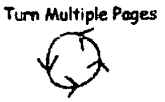

FIG. 24

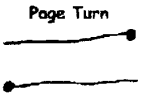

FIG. 23

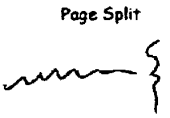

FIG. 22

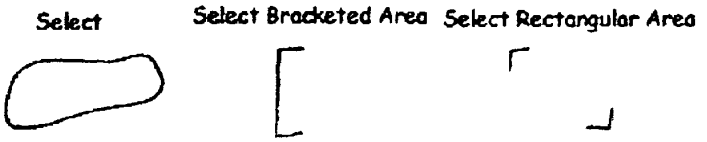

FIG. 26

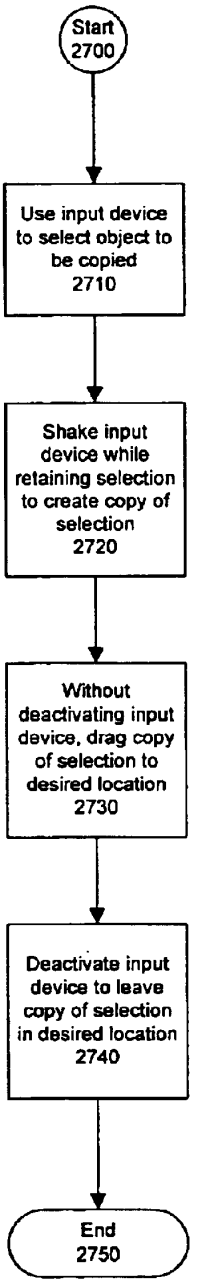
Start
2700
Use input device to select object to be copied
2710
Shake input device while retaining selection to create copy of selection
2720
Without deactivating input device, drag copy of selection to desired location
2730
Deactivate input device to leave copy of selection in desired location
2740
End
2750

FIG. 27

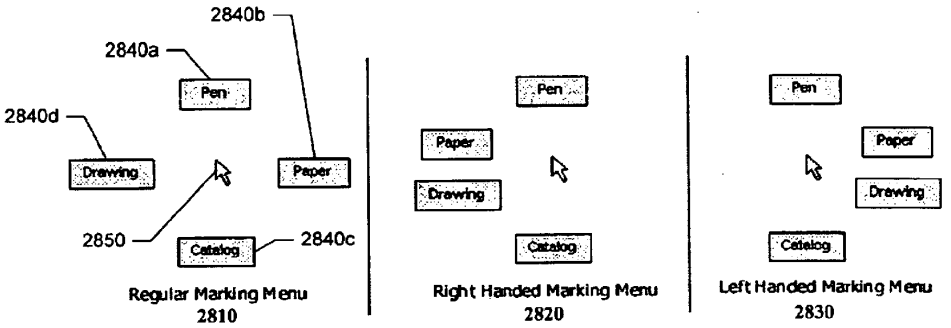
2840b
2840a
Pen
2840d
Drawing
Paper
2850
Catalog
2840c
Regular Marking Menu
2810
Pen
Paper
Drawing
Catalog
Right Handed Marking Menu
2820
Pen
Paper
Drawing
Catalog
Left Handed Marking Menu
2830

FIG. 28

SYSTEM AND METHOD FOR ANNOTATING WEB-BASED DOCUMENTS

FIELD OF THE INVENTION

The present invention relates to a system and method of marking, organizing, and searching Web-based documents.

BACKGROUND INFORMATION

Standard desktop word processing applications enable computer users to create and edit text-based documents. To provide computer users with more flexibility in the editing and markup of these documents, software utilities exist that integrate electronic sticky notes and users' on screen drawing directly into the document. This type of document annotation enables users to mark and view documents on screen as if the documents were in front of them on paper.

However, the current annotation system requires users to annotate documents compatible with specific word processing applications that lack portability. For example, if a user wanted to send another person an annotated document, the user would have to e-mail the document as an attachment and hope the recipient has the same application software to view the document

Accordingly, there is a need in the art for a simple method and system of annotating and collecting Web-based documents. There is a need for the integration of any type of annotation, including text, ink, highlighter and audio, directly into Web-based documents, such that any person with a Web browser may view the annotations, with or without the software used to create the annotations. There is also a need for a method and system of annotating and collecting blank Web-based documents, effectively converting a Web browser into an online notebook/scrapbook.

SUMMARY OF THE INVENTION

The present invention relates to the integration of any annotation, including ink, highlighter, text-based notes and audio, directly into a Web-based document (WBD) displayed by a Web browser. This integration enables others to view the personalized annotated WBD, which retains its original active links and properties, over the Internet without the need for specialized software. Annotations are integrated into WBDs by freezing the WBD, overlaying an image file containing the annotations onto the WBD, and enabling browser events to pass through the image layer. Annotations may also be integrated into WBDs by using component object technology. The present invention collects and organizes annotated WBDs, and provides users with an intuitive Web-based interface for accessing, viewing and searching the annotated WBDs. Users may annotate blank WBDs, effectively converting their Web browsers into online notebooks/ scrapbooks. The present invention also provides users with many novel interface techniques, such as dog-ears and its associated navigation tools, splitting pages, turning pages, selecting and copying various portions of a WBD (including shaking out a copy), and marking menus suited for right-handed or left-handed users.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram depicting the internal structure of a user's computer in accordance with an exemplary embodiment of the present invention.

FIG. **2** is a block diagram depicting a network architecture that facilitates the storing, searching and transfer of annotated WBDs in accordance with an exemplary embodiment of the present invention.

FIG. **3** depicts a data structure of a user record that is used to store information in a user information database in accordance with an exemplary embodiment of the present invention.

FIG. **4** depicts a data structure of a folder record that is used to store information in a user folder database in accordance with an exemplary embodiment of the present invention.

FIG. **5** depicts a data structure of an annotation record that is used to store information in an annotation database in accordance with an exemplary embodiment of the present invention.

FIG. **6** depicts a data structure of a stroke record that is used to store information in a stroke database in accordance with an exemplary embodiment of the present invention.

FIG. **7** depicts a data structure of a note record that is used to store information in a note database in accordance with an exemplary embodiment of the present invention.

FIG. **8** depicts an annotated WBD in accordance with an exemplary embodiment of the present invention.

FIG. **8**A depicts a pop-up menu from an annotation toolbar in accordance with an exemplary embodiment of the present invention.

FIG. **9** is a flowchart of steps for freezing WBD content in accordance with an exemplary embodiment of the present invention.

FIG. **10** depicts the imposition of an image file onto a WBD in accordance with an exemplary embodiment of the present invention.

FIG. **11** is a flowchart of steps for annotating into a Web browser in accordance with an exemplary embodiment of the present invention.

FIG. **12** is a block diagram depicting the structure of WBD layers that enable Web browser events to pass through annotations in accordance with an exemplary embodiment of the present invention.

FIG. **13** is a flowchart of steps for passing Web browser events through annotations in accordance with an exemplary embodiment of the present invention.

FIG. **14** is a flowchart of steps for drawing into a Web browser via a control object in accordance with an exemplary embodiment of the present invention.

FIG. **15** illustrates a thumbnail margin in accordance with an exemplary embodiment of the present invention.

FIG. **15**A illustrates an online notebook/scrapbook in accordance with an exemplary embodiment of the present invention.

FIG. **16** illustrates a search interface in accordance with an exemplary embodiment of the present invention.

FIG. **17** is a flowchart of steps for recognizing gestures in accordance with an exemplary embodiment of the present invention.

FIG. **18** depicts a dog-eared WBD in accordance with an exemplary embodiment of the present invention.

FIG. **19** depicts a navigation widget in accordance with an exemplary embodiment of the present invention.

FIG. **20** is a flowchart of steps for creating, deleting, and navigating through dog-ears in accordance with an exemplary embodiment of the present invention.

FIG. **21** depicts a flip to dog-ear gesture representation in accordance with an exemplary embodiment of the present invention.

FIG. **22** depicts a page split gesture representation in accordance with an exemplary embodiment of the present invention.

FIG. **23** depicts a page turn gesture representation in accordance with an exemplary embodiment of the present invention.

FIG. **24** depicts a spiral page-turning gesture representation in accordance with an exemplary embodiment of the present invention.

FIG. **25** is a flowchart of steps for turning multiple pages with a dynamic gesture in accordance with an exemplary embodiment of the present invention.

FIG. **26** depicts three selection gesture representations in accordance with an exemplary embodiment of the present invention.

FIG. **27** is a flowchart of steps for performing a shaking out a copy gesture in accordance with an exemplary embodiment of the present invention.

FIG. **28** illustrates a tap and dwell menu in accordance with a pen-based embodiment of the present invention.

DETAILED DESCRIPTION

Introduction

The present invention fulfills this need in the art by allowing computer users to integrate any annotation, including ink, highlighter, text-based notes and audio, directly into a Web-based document (WBD) displayed by a Web browser. Users may create annotations on preexisting WBDs or new blank WBDs, and can collect and organize annotated WBDs through an intuitive Web-based interface using many novel interface techniques.

INFRASTRUCTURE

FIG. **1** is a block diagram depicting the internal structure of a user's computer in accordance with an exemplary embodiment of the present invention. User computer **100** may be a personal computer, handheld personal digital assistant ("PDA"), or any other type of microprocessor-based device. User computer **100** may include a processor **110**, input device **120**, output device **130**, temporary storage device **140**, resident storage device **150**, and communication device **180**. Input device **120** may include a keyboard, mouse, pen-operated touch screen, voice recognition device, and any other device that provides input from a user. Output device **130** may include a monitor, printer, disk drive, speakers, or any other device that provides tangible output to user. Temporary storage device **140** may include RAM, caches, and any other volatile storage medium that temporarily holds data while processing it. Resident storage device **150** may include a hard drive, CD-ROM drive, tape drive, removable storage disk, or any other nonvolatile data storage medium. Annotation software **170** and software for a Web browser **160** may reside in resident storage device **150**. Annotation software **170** may include, among others, a Web browser plug-in, independent software program or a feature of an operating system. Web browser **160** may include, among others, Microsoft's Internet Explorer or Netscape Navigator. Communication device **180** may include a modem, network interface card, or any other device able to transmit and receive signals over a network. One skilled in the art would appreciate that the components of user computer **100** may also be connected wirelessly, possibly through an infrared connection.

FIG. **2** is a block diagram depicting a network architecture that facilitates the storing, searching and transfer of annotated WBDs in accordance with an exemplary embodiment of the present invention. According to one embodiment, after user **200** annotates a WBD through Web browser **160**, annotation software **170** transmits it to annotation repository **240** (i.e., server arrangement) via network link **210***a*, Internet service provider **220**, network link **210***b*, Internet **230**, and network link **210***c*. Network link **210** may include telephone lines, DSL, cable networks, T1 lines, ATM/SONNET, wireless networks, or any other arrangement that allows for the transmission and reception of network signals. It should be noted that, technically, user computer **100**, Internet service provider **220** and Web server cluster **250** are also part of the Internet **230** because of their connectivity.

In an exemplary embodiment, annotation repository **240** is a Website that receives the annotated WBD through its Web server cluster **250**, which may comprise a collection of Web server computers working in tandem to distribute the load of network traffic. These Web servers include processors and memory for executing program instructions as well network interfaces. Annotation repository **240** also comprises, among other components, user information database **260**, user folder database **270**, annotation database **280**, stroke database **290** and note database **295**. Those skilled in the art realize that these single-record databases may be represented in many different ways, such as individual tables in one or more relational databases. Although all annotation-related information is sent to annotation repository **240**, this information may also be stored in temporary storage device **140** or resident storage device **150** for efficiency reasons.

FIG. **3** depicts a data structure of a user record that is used to store information in user information database **260** in accordance with an exemplary embodiment of the present invention. Each user record represents a single unique user of annotation repository **240**, and a user record is created when a user **200** creates an account online. In particular, user record **300** includes a user ID **310** field, a user name **320** field, a user e-mail **330** field, a user password **340** field, and a list of folder IDs **350** field. User ID **310** contains an integer value that identifies each user record **300** in user information database **260**. User name **320** contains a unique ASCII string that represents each user **200** associated with annotation repository **240**. User e-mail **330** contains a unique ASCII string that represents the e-mail address of each user **200** associated with annotation repository **240**. User password **340** contains a unique ASCII string chosen for security purposes by each user **200** associated with annotation repository **240**. The password may be encrypted using any standard UNIX utility, such as salt or crypt. And list of folder IDs **350** contains a linked list of references to records stored in user folder database **270**.

FIG. **4** depicts a data structure of a folder record that is used to store information in user folder database **270** in accordance with an exemplary embodiment of the present invention. Each folder record contains a list of annotated WBDs that relate to a certain category for each user **200**. In particular, folder record **400** includes a folder ID **410** field, a category **320** field, and a list of annotation IDs **430** field. Folder ID **410** contains an integer value that identifies each folder record **400** in user folder database **270**. Category **420** contains an ASCII string that describes the category of associated annotated WBDs. And list of annotation IDs **430** contains a linked list of references to records stored in annotation database **280**.

FIG. **5** depicts a data structure of an annotation record that is used to store information in annotation database **280** in accordance with an exemplary embodiment of the present invention. Each annotation record contains all pertinent

information relating to the appearance and make-up of a single annotated WBD associated with annotation repository **240**. In particular, annotation record **500** includes an annotation ID **510** field, an original WBD URL **515** field, a URL content hash **520** field, an annotation size **525** field, a time/data stamp **530** field, a dog-ear **535** field, a pointer to original WBD **540** field, a pointer to image file **545** field, a pointer to thumbnail file **548**, a list of stroke IDs **550** field, and a list of note IDs **555** field.

Annotation ID **510** contains an integer value that identifies each annotation record **500** in annotation database **280**. Original WBD URL **515** contains an ASCII string representing the Internet address of the unannotated WBD. URL content hash **520** contains an integer value that results from the execution of a standard hash function on the contents of the WBD. Annotation repository **240** uses this value to generate an Internet address for the annotated WBD that can be mapped to the annotated WBD's location in annotation database **280**. Annotation size **525** contains an integer value representing the size in bytes of the annotated WBD. Time/date stamp **530** contains an ASCII string representing the time and date that user **200** generated the annotated WBD. Dog-ear **535** stores a boolean value representing whether annotated WBD is marked as a dog-ear ("true") or not ("false"); the default value is "false." Pointer to original WBD **540** stores the file location of the unannotated WBD, pointer to image file **545** stores the file location of the image file containing the appearance of the annotations, and pointer to thumbnail file **548** stores the file location of the image file containing the miniaturized annotated WBD. List of stroke IDs **550** contains a linked list of references to records stored in stroke database **290**, while list of note IDs **555** contains a linked list of references to records stored in note database **295**.

If a great number of users **200** annotate the same WBD (or similar versions of the same WBD with different advertisements), annotation repository **240** in an exemplary embodiment can conserve disk space by storing "DIFF" files instead of the complete WBD multiple times in annotation database **280**. DIFF files are generated by the standard UNIX utility diff, and contain only the different content between similar files or WBDs. Thus, pointer to original WBD **540** could reference the original WBD once, and if subsequent users **200** annotate the same WBD, pointer to original WBD **540** would then reference a much smaller DIFF file that contains the information later used in reconstructing the original WBD.

FIG. **6** depicts a data structure of a stroke record that is used to store information in stroke database **290** in accordance with an exemplary embodiment of the present invention. Each stroke record contains all pertinent information relating to a single brush stroke generated by a user **200**. In particular, stroke record **600** includes a stroke ID **610** field, a brush width **620** field, a brush height **630** field, a brush shape **640** field, a brush color **650** field, a brush opacity **660** field, and a list of points **670** field. Stroke ID **610** contains an integer value that identifies each stroke record **600** in stroke database **290**. Brush width **620** and brush height **630** contain integer values that represent the pixel size of the brush width and height, respectively. Brush shape **640** stores an integer enumeration indicating whether the brush is square, round, or otherwise. Brush color **650** stores an integer value representing the red, green and blue components of the brush's color. Brush opacity **660** stores an integer value representing how the brush blends with its background. And list of points **670** contains a list of x and y coordinates of the locations where user **200** draws onto the WBD.

FIG. **7** depicts a data structure of a note record that is used to store information in note database **295** in accordance with an exemplary embodiment of the present invention. Each note record contains all pertinent information relating to text-based note and audio annotations. In particular, note record **700** includes a note ID **710** field, a note type **720** field, a note text **730** field, and a pointer to audio file **740** field. Note ID **710** contains an integer value that identifies each note record **700** in note database **295**. Note type **720** contains a type enumeration that allows for standard yellow sticky notes, "thought" bubbles, rubber stamps, and other types of note appearances. Note text **730** contains an ASCII string that represents the text that user **200** types into the note, and pointer to audio file **740** stores the file location in note database **295** of an audio file associated with note record **700**.

Annotation

FIG. **8** depicts an annotated WBD in accordance with an exemplary embodiment of the present invention. Annotation software **170** enables user **200** to write and draw ink, highlighter and other marks with input device **120**, to incorporate text-based notes in small movable windows, and to add audio annotations directly into a WBD displayed by Web browser **160**. The result is an annotated WBD **800** that can be sent to other people for viewing over the Internet **230**, with or without annotation software **170** installed on the recipients' computers.

According to one embodiment, annotation software **170** displays an annotation toolbar **805** along the bottom edge of Web browser **160**. Annotation toolbar **805** allows, for example, user **200** to select an annotation tool and send an annotation link by e-mail. Users **200** may also access their account with annotation repository **240** and change their user preferences via annotation toolbar **805**. By clicking on the small arrow next to the pen button on annotation toolbar **805**, a small pop-up menu appears, as shown in FIG. **8A**, listing pen choice **830**, highlighter choice **840**, eraser choice **850**, and pen options choice **860**.

Selecting pen choice **830** can turn input device **120** into an inking device that allows user **200** to underline, bracket, and draw any other type of ink-mark **810** directly onto annotated WBD **800**. Selecting highlighter choice **840** can turn input device **120** into an inking device that allows user **200** to draw any type of highlight-mark **815** onto any part of annotated WBD **800**. And selecting erase choice **850** can turn input device **120** into an erasing device that allows user **200** to remove any ink-mark **810** or highlight-mark **815** that exists on annotated WBD **800**. Pen options choice **860** allows user **200** to customize certain features of the inking device, such as color and shape.

By clicking on the note button on annotation toolbar **805**, a small movable note window **820** appears on annotated WBD **800** into which user **200** may type text. The note window **820** also contains along its bottom border an audio annotation menu bar **825**, which allows user **200** to easily add an audio dictation to annotated WBD **800**. For example, when user **200** clicks on the record button (the round button on audio annotation menu bar **825**), annotation software records sound until the stop button is pressed (the square button on audio annotation menu bar **825**). To play the recording back, user **200** selects the play button (the triangle button on audio annotation menu bar **825**).

Inking Technology

Multiple underlying technologies enable user **200** to annotate a WBD. In one exemplary embodiment, annotation software **170** first freezes the WBD, so that resizing Web

browser **160** after annotating the WBD will not affect the positioning of the annotations with respect to the underlying WBD. Annotation software **170** then allows user **200** to annotate into Web browser **160** by inserting on top of the WBD a transparent image file that contains the annotations. And finally, annotation software **170** allows browser events to pass through the annotation image file so that user **200** has complete access to the underlying WBD. These technologies are integrated into the physical WBD, so that annotated WBD **800** may be viewed by anyone with a Web browser **160**, with or without annotation software **170**.

Freezing WBDs

Since annotations are overlaid on the WBD, if, due to resizing, Web browser **160** reflows text underneath the annotations, the annotation will not match up with the underlying WBD. Thus, freezing WBD content prevents Web browser **160** from re-flowing text and images when user **200** resizes Web browser **160**, so that the positioning of any annotations will remain fixed with respect to the underlying WBD.

FIG. **9** is a flowchart of steps for freezing WBD content in accordance with an exemplary embodiment of the present invention. To freeze a WBD in general, annotation software **170** first gains access to the content of the WBD (step **905**). Since some WBDs are composed of different layers that may behave differently upon browser resizing, annotation software **170** wraps the existing WBD layers into one fix-sized layer (step **910**). With all the layers wrapped, the next task is to examine the properties of the WBD elements (step **915**). WBD elements, which encompass any content on the WBD (e.g., single word, paragraph, image, buttons implemented in JavaScript), may contain certain properties that cause the element to move during browser resizing. For instance, an element property may require the element to stay fixed to the size of the WBD no matter how the browser is sized. Therefore, if a WBD element contains properties that cause that element to become unfrozen ("yes" branch of step **920**), then those properties are modified so that the element remains in a fixed position through browser resizing (step **925**). Since WBD elements are organized in a tree-like fashion, with the root element at the top and all children below, the next inquiry is whether children elements exist (step **930**). If children elements exist, their properties are similarly examined (step **935**) and, if appropriate, modified (step **925**), and the process repeats until all elements have been examined ("no" branch of step **930**).

One exemplary embodiment in accordance with the present invention uses the Internet Explorer ("IE") implementation of the Document Object Model ("DOM") in combination with Cascading Style Sheets ("CSS") and Dynamic-HTML ("DHTML") World Wide Web technology. The Document Object Model is a platform-neutral and language-neutral specification that allows programs and scripts to dynamically access and update the content, structure and style of WBDs. CSS is a standard approved by the World-Wide-Web Consortium that allows WBD authors greater flexibility in specifying how their WBDs should be formatted inside a browser. For example, these style sheets make it possible to insert elements on a WBD that "snap" to the sides of a browser, akin to left or right justified text, so that they move with the browser window as it is resized. DHTML functionality allows WBD authors to create multiple overlaid layers of HTML inside a single WBD, and also enables WBDs to alter their content programmatically.

The method according to this embodiment starts at step **900**. Through a combination of C++ and JavaScript, annotation software **170** employs the DOM to access the contents of a WBD (step **905**) by using the document.body.innerHTML property. Annotation software **170** wraps the existing DHTML layers to a fix-sized DHTML layer (step **910**) by inserting a <DIV>(new DHTML layer) tag before the contents of the original WBD and setting its CSS STYLE properties with "position:absolute; width:<width_of_browser>". A close <DIV> tag is inserted at the end of the WBD's document.body element to keep the WBD valid. Inserting the DIV layer effectively tells IE to render (i.e., lay out the contents of the WBD into the browser) all HTML inside the DIV layer within a particular width.

Adding the DIV tag freezes a significant number of WBDs in their entirety, but WBDs that utilize CSS or DHTML may still contain unfrozen elements. To ensure that every element in the tree of WBD elements remains frozen upon window resizing, annotation software **170** examines the properties of the document.body element (step **915**), which is the root of the tree. It determines if this body element contains any properties that could cause the element to become unfrozen (step **920**), such as "position:absolute" or "centered". The "position:absolute" property could cause an element to become unfrozen because it would not be positioned relative to the newly inserted fixed-sized DIV layer. If no such properties exist ("no" branch of step **920**), annotation software **170** proceeds to step **930** to examine any children elements. If these properties do exist ("yes" branch of step **920**), they are modified to freeze the element (step **925**) by using the "position:relative" or "normal" properties. If no children elements are found to exist ("no" branch of step **930**), the method terminates (step **940**). If any children elements do exist ("yes" branch of step **930**), their properties are examined (step **935**) and the same process (step **920** and step **925**) is recursively repeated until all children elements in the tree have been examined and, if applicable, modified.

Annotating into the Browser

Since most modem Web browsers internally maintain their own graphics contexts (buffers that enable the browsers to draw to the screen) and HTML rendering code, browser plug-in developers currently have no ability to enable drawing directly into a browser. Thus, the present invention overlays an active image file onto the WBD to simulate drawing directly into the browser, as shown in FIG. **10**.

FIG. **11** is a flowchart of steps for drawing into a Web browser **160** in accordance with an exemplary embodiment of the present invention. In general, the method starts when user **200** views a new WBD **1010** that user **200** would like to annotate (step **1160**). Annotation software **170** creates a new annotation record **500** to capture information about user **200**'s annotations on WBD **1010** (step **1105**). Annotation software **170** next overlays a blank image file **1000** on top of a WBD **1010**(step **1110**), as shown in FIG. **10**. As long as the current WBD **1010** is still displayed in Web browser **160** ("yes" branch of step **1115**), annotation software **170** waits for user **200** to initiate an annotation event, which comprises drawing, adding a text note, or adding an audio note to WBD **1010** (step **1120**). Once the annotation event is initiated ("yes" branch of step **1120**), annotation software **170** accesses the display mechanism for the entire computer screen (step **1125**). Since this would enable user **200** to place the annotation element anywhere on the entire computer screen, annotation software **170** restricts user **200**'s annotation to the boundaries of Web browser **160** (step **1130**). After user **200** completes the annotation event, technical annotation information (e.g., the annotation image, the data representing annotation location and attributes, etc.) is appended

to annotation record **500** (step **1135**). In this step, the annotation image is appended to image file **1000**, so when annotation software **170** signals Web browser **160** to reload WBD **1010** (step **1140**), the newly integrated annotated WBD **800** is displayed. This seamless process continues until user **200** leaves the annotated WBD **800** ("no" branch of step **1115**), at which time the process ends (step **1145**).

One exemplary embodiment in accordance with the present invention uses the IE implementation of the DOM in combination with CSS and DHTML technology. The method starts when user **200** views a new WBD **1010** that user **200** would like to annotate (step **1100**). When user **200** presses one of the buttons on annotation toolbar **805**, annotation software **170** creates a new annotation record **500** in annotation database **280** to capture information about user **200**'s annotations on WBD **1010** (step **1105**). Note that although annotation software **170** sends all annotation-related information to annotation repository **240**, this information may also be stored in temporary storage device **140** or resident storage device **150** for efficiency reasons. At this time, annotation software **170** creates a unique identifier for WBD **1010** in the annotation ID **510** field of annotation record **500**. Annotation software **170** places the Internet address of unannotated WBD **1010** in the original WBD URL **515** field, places a time and date stamp into time/date stamp **530** field, and copies WBD **1010** into annotation database **280**, storing its location in the pointer to original WBD **540** field. Annotation software **170** also creates in annotation database **280** a default-sized image file, and stores its location in pointer to image file **545**.

Annotation software **170** next overlays the standard-format (e.g., tiff, gif, or png) blank image file **1000** on top of WBD **1010** (step **1110**), as shown in FIG. **10**. This is accomplished by creating a new DHTML layer in WBD **1010** using the <DIV>HTML tag, and inserting a standard <IMG> HTML tag in the new DHTML layer to incorporate the blank image file **1000**. The image file **1000** is set to be transparent in locations where no annotation is positioned. Transparency is a standard provision of many file formats, including those enumerated above.

As long as the current WBD **1010** is still displayed in Web browser **160** ("yes" branch of step **1115**), annotation software **170** waits for user **200** to initiate an annotation event, which comprises drawing an ink-mark **810**, drawing a highlight-mark **815**, adding a text annotation or adding an audio dictation (step **1120**). Once the annotation event is initiated ("yes" branch of step **1120**), annotation software **170** acquires the global graphics context of the entire computer screen (step **1125**). This global graphics context is accessible because it is maintained by the operating system, which may comprise, among others, Microsoft Windows or NT, MacOS, or some variation of UNIX. Since this access would enable user **200** to annotate anywhere on the screen through standard operating system calls, annotation software **170** clips user **200**'s annotation element so that it remains within the boundaries of Web browser **160** (step **1130**).

After user **200** initiates an annotation event, annotation software **170** appends technical information about the annotation into annotation record **500** (step **1135**). In this step, the annotation image is appended to image file **1000** referenced by a pointer to image file **545**. Annotation software **170** positions the annotation element so that the location of the drawing marks in image file **1000** corresponds to the location of the drawing marks that user **200** made on the screen.

Annotation software **170** creates a new stroke record **600** in stroke database **290** for every mark that user **200** draws into Web browser **160**. For each stroke record **600**, annotation software **170** generates a unique ID number for stroke ID **610**, and adds that ID number to the list of stroke IDs **550** of the associated annotation record **500**. Annotation repository **240** stores the appropriate values for brush width **620**, brush height **630**, brush shape **640**, brush color **650**, and brush opacity **660**, and stores the data points or coordinates of the annotation stroke in the list of points **670**. In an exemplary embodiment, annotation software **170** may store into stroke record **600** information extracted through the DOM like the current scroll position of WBD **1010** and the size of Web browser **200**'s window, along with number of direction changes, length of stroke, horizontal and vertical dot products, and time elapsed from start to end of stroke.

Annotation software **170** creates a new note record **700** in note database **295** for every text-based note or audio annotation that user **200** creates. For each note record **700**, annotation software **170** generates a unique 1D number for note ID **710**, and adds that ID number to the list of note IDs **555** of the associated annotation record **500**. Annotation repository **240** stores the type of note in note type **720**, and the text of the note in note text **730**. If user **200** associates an audio annotation with the note, the audio annotation is stored in an audio file in streaming audio format (e.g., .wav., .mps, RealAudio) in note database **295**, and its location is stored in a pointer to audio file **740**.

Since image file **1000**, which is overlaid on top of WBD **1010**, is updated with the new annotation image, when annotation software **170** signals Web browser **160** to reload WBD **1010** (step **1140**), the newly integrated annotated WBD **800** is displayed. This process continues until user **200** leaves the annotated WBD **800** ("no" branch of step **1115**), at which time the process ends (step **1145**). This entire process from on-screen ink to in-browser ink is seamless, and transparent to user **200**.

Passing Browser Events Through Annotations

As is known in the art, standards-compliant Web browsers **160** are required to pass events (e.g., keyboard strokes, mouse clicks, etc.) from the lowest element in the WBD's element tree, up the tree, and eventually to the root element (i.e., document.body element). Since the image file **1000** created by annotation software **170** overlays the prior top-most WBD layer, it blocks input device **120** events (e.g., mouse clicks) from reaching the original unannotated WBD **1010**. Thus, the present invention "burns a hole" centered around user **200**'s input device pointer (i.e., cursor) in the image file **1000** layer, so that input device **120** events can find their way to original WBD **1010** below.

FIG. **13** is a flowchart of steps for passing Web browser events through annotations in accordance with an exemplary embodiment of the present invention. This method commences when user. **200** views a new WBD **1010** (step **1300**). Annotation software **170** inserts multiple versions of the same image file **1000** on top of WBD **1010** (step **1305**) and then starts to monitor input device **120** movements (step **1310**). When input device **120** moves (step **1315**), annotation software **170** dynamically clips the viewable rectangular portion of each image file **1000** in such a way that no part of any image file **1000** is visible at the point directly beneath input device **120** (step **1320**). The clipping rectangle of image file **1000** determines which portion of image file **1000** is visible. This is illustrated in FIG. **12**, in which the four clipping rectangles **1200***a*–**1200***d* of image file **1000** are arranged so that no image projects through the hole **1210**, which represents the minuscule point directly beneath input device **120**. Since no image projects through the hole **1210**

beneath input device **120**, input device **120** events are able to reach the original unannotated WBD **1010**. This method of FIG. **13** does not end, it just restarts when user **200** views a different WBD **1010**.

One exemplary mouse-driven embodiment in accordance with the present invention uses the IE implementation of the DOM in combination with CSS and DHTML technology. This method commences when user **200** views a new WBD **1010** (step **1300**). In order to "burn a hole" into a DHTML layer, annotation software **170** initially creates four identical DHTML layers containing the full image file **1000**, and inserts them into WBD **1010** (step **1305**). The four layers are inserted by using the <DIV> tag, and, using CSS properties, they are positioned absolutely at the top-left corner of WBD **1010** so that they cannot be resized. Annotation software **170** then inserts a hook into WBD **1010**'s onmousemove( ) handler (step **1310**). When Web browser **160** notifies annotation software **170** through this handler that the mouse has moved (step **1315**), annotation software **170** dynamically changes, through DHTML, the clip property of the four instantiations of image file **1000** so that no image is displayed directly underneath the mouse (step **1320**). This method does not end, it just restarts when user **200** views a different WBD **1010**.

Alternative Annotation Method

In an alternative embodiment, the present invention still freezes the WBD as an initial step, but the WBD is annotated through the use of component object technology. Component objects, or control objects, are part of a component framework that enables these objects to become embedded within documents (including WBDs) to communicate with one another and with the framework. There are numerous component object technologies; some exist for multiple operating systems and browsers, and others exist for single operating systems and browsers. Component object framework implementations vary widely.

FIG. **14** is a flowchart of steps for drawing into a Web browser **160** via a control object in accordance with an exemplary embodiment of the present invention. In general, the method starts when user **200** views a new WBD **1010** that user **200** would like to annotate (step **1400**).

Annotation software **170** creates a new annotation record **500** to capture information about user **200**'s annotations on WBD **1010** (step **1405**). Annotation software **170** next inserts a control object into Web browser **160** (step **1410**). As long as the current WBD **1010** is still displayed in Web browser **160** ("yes" branch of step **1415**), annotation software **170** waits for user **200** to initiate an annotation event, which comprises drawing, adding a text note, or adding an audio note to WBD **1010** (step **1420**). Once the annotation event is initiated ("yes" branch of step **1420**), annotation software **170** enables the control object to capture input device **120**'s movements (step **1425**), and places the annotation element on WBD **1010** in response to input device **120**'s movements (step **1430**). After user **200** completes the annotation event, annotation software **170** disables the control object from capturing input device **120**'s movements (step **1435**), and appends technical annotation information (e.g., vector stroke information, data representing annotation attributes, etc.) to annotation record **500** (step **1440**). When annotation software **170** signals Web browser **160** to reload WBD **1010** (step **1445**), the newly annotated WBD **800** is displayed. This seamless process continues until user **200** leaves the annotated WBD **800** ("no" branch of step **1415**), at which time the process ends (step **1450**).

One exemplary embodiment in accordance with the present invention makes use of ActiveX control technologies available for IE. ActiveX control technologies build on previous Microsoft Windows technologies, including COM ("Component Object Model") and OLE (Object Linking and Embedding"), and allow programmers to create "Internet aware" controls. A control in the most basic sense is a GUI ("graphical user interface") widget such as a button, scrollbar, or text entry area. Normally each control has a separate window, which is a rectangular portion of the computer screen in which drawing can be performed. However, ActiveX controls can be "windowless," which result in unusually shaped controls and transparency. This transparency allows browser events to pass directly through the control, without the "hole burning" techniques explained above.

The method according to this embodiment starts when user **200** views a new WBD **1010** that user **200** would like to annotate (step **1400**). When user **200** presses one of the buttons on annotation toolbar **805**, annotation software **170** creates a new annotation record **500** in annotation database **280** to capture information about user **200**'s annotations on WBD **1010** (step **1405**). Note that although annotation software **170** sends all annotation-related information to annotation repository **240**, this information may also be stored in temporary storage device **140** or resident storage device **150** for efficiency reasons. At this time, annotation software **170** creates a unique identifier for WBD **1010** in the annotation ID **510** field of annotation record **500**. Annotation software **170** places the Internet address of unannotated WBD **1010** in the original WBD URL **515** field, places a time and date stamp into time/date stamp **530** field, and copies WBD **1010** into annotation database **280**, storing its location in the pointer to original WBD **540** field.

Annotation software **170** next inserts a control object into Web browser **160** (step **1410**). This is accomplished through COM interfaces supported by IE. Annotation software **170** initially sets the ActiveX control object to be completely transparent, and positions it at the top-left corner of Web browser **160**. The initial size of the control is arbitrarily small (e.g., 20 pixels square).

As long as the current WBD **1010** is still displayed in Web browser **160** ("yes" branch of step **1415**), annotation software **170** waits for user **200** to initiate an annotation event, which comprises drawing an ink-mark **810**, drawing a highlight-mark **815**, adding a text annotation or adding an audio dictation (step **1420**). Once the annotation event is initiated ("yes" branch of step **1420**), annotation software **170** enables the control object to capture input device **120**'s movements through ActiveX control's EnableCapture method (step **1425**). As user **200** moves the enabled input device **120**, the ActiveX control inherently resizes itself as necessary to fit all of user **200**'s strokes inside its boundaries. In addition, as user **200** drags input device **120**, the ActiveX object redraws itself to reflect the new lines that are drawn. Using standard method calls to the ActiveX control, annotation software **170** places the annotation element onto the computer screen in response to input device **120**'s movements (step **1430**), and then disables the control object from capturing input device **120** movements (step **1435**).

After user **200** initiates an annotation event, annotation software **170** appends technical information about the annotation into annotation record **500** (step **1440**). In this embodiment, annotation software **170** does not need to store an annotation image file to be superimposed over the actual WBD. Instead, the ActiveX object uses the vector stroke data stored in stroke database **290** to re-form, on screen, the stroke image. However, since this implementation is currently limited to Microsoft Window's machines, annotation

software **170** may still construct the appropriate image file for storage in annotation repository **240**, in order to allow any person on any machine access to the annotated WBD's **800**.

In step **1440**, annotation software **170** creates a new stroke record **600** in stroke database **290** for every mark that user **200** draws into Web browser **160**. For each stroke record **600**, annotation software **170** generates a unique ID number for stroke ID **610**, and adds that ID number to the list of stroke IDs **550** of the associated annotation record **500**. Annotation repository **240** stores the appropriate values for brush width **620**, brush height **630**, brush shape **640**, brush color **650**, and brush opacity **660**, and stores the data points or coordinates of the annotation stroke in the list of points **670**. In an exemplary embodiment, annotation software **170** may store into stroke record **600** information extracted through the DOM like the current scroll position of WBD **1010** and the size of Web browser **200**'s window, along with number of direction changes, length of stroke, horizontal and vertical dot products, and time elapsed from start to end of stroke.

Annotation software **170** creates a new note record **700** in note database **295** for every text-based note or audio annotation that user **200** creates. For each note record **700**, annotation software **170** generates a unique ID number for note ID **710**, and adds that ID number to the list of note IDs **555** of the associated annotation record **500**. Annotation repository **240** stores the type of note in note type **720**, and the text of the note in note text **730**. If user **200** associates an audio annotation with the note, the audio annotation is stored in an audio file in streaming audio format (e.g., .wav., .mp3, RealAudio) in note database **295**, and its location is stored in pointer to audio file **740**.

In step **1445**, annotation software **170** signals Web browser **160** to reload WBD **1010**, causing the ActiveX object to use the vector stroke data to display the newly annotated WBD **800**. This entire process continues until user **200** leaves the annotated WBD **800** ("no" branch of step **1415**), at which time the process ends (step **1450**). The process from on-screen ink to in-browser ink is seamless, and transparent to user **200**.

ORGANIZATIONAL TOOLS

Collecting Annotated Information

The present invention acts as an online notebook/scrapbook in the way it collects and organizes WBDs. Standard browsers enable WBDs to be collected (e.g., via "favorites" or "bookmarks"), but annotation repository **240** allows users **200** to mark WBDs for collection simply by adding annotations. Any time user **200** marks a WBD, annotation software **170** sends the information from user computer **100** to annotation repository **240** in the background, so as not to disrupt user **200** from browsing the Internet **230**.

Annotation software **170** provides user **200** with a margin inside Web browser **160** in which to group thumbnails (i.e., miniaturized images) of annotated WBDs **800**. FIG. **15** illustrates a thumbnail margin in accordance with an exemplary embodiment of the present invention. After user **200** completes annotating a WBD, annotation software **170** automatically generates a thumbnail **1515** of the newly annotated WBD **800** and displays it in margin **1510**. User **200** may assign each thumbnail **1515** a user-defined category **1520**, which is listed along the left border of margin **1510**. In this embodiment, annotation repository **240** generates each thumbnail using standard 2D image processing techniques, and stores each file containing the thumbnail image into annotation database **280**, along with the file location in pointer to thumbnail file **548** of the associated annotation record **500**. Annotation repository **240** stores the user-defined category in category **420** of the associated folder record **400**, making sure the associated annotation record **500** is linked to the list of annotation IDs **430**.

The present invention also allows users **200** to annotate blank WBDs. Annotating blank WBDs is no different that annotating WBDs with preexisting content. As shown in FIG. **15**A, which is an exemplary embodiment of an online notebook/scrapbook, users **200** have a limitless forum in which to collect, organize and store their notes. As with regular annotated WBDs **800**, these notes may comprise colored marks, highlighting, text-based windows and audio annotations. The notes may be placed into any user-defined category, and may be viewed and searched as described below.

Viewing/Searching by Inking Technology

The present invention provides user **200** with an intuitive Web-based interface for accessing, viewing and searching the WBDs that user **200** has annotated. This interface enables user **200** to search any annotated WBD **800** by its annotation attributes, which include, among others, time of annotation (e.g., last week, today, etc.), color of ink-mark **810**, shape of annotation (e.g., user-defined star or underline), category **1520**, author, and Website. An embodiment of the search interface **1600** in accordance with the present invention is illustrated in FIG. **16**.

According to one embodiment, annotation software **170** implements viewing and searching of annotated WBDs **800** by comparing user **200**'s search parameters **1610**, which user **200** enters through search interface **1600** of Web browser **160**, with the associated fields of the relevant records in annotation repository **240**. For example, if user **200** wants to view all annotated WBDs **800** assigned a specific category **1520**, annotation software **170** searches the category **420** field of folder record **400** in user folder database **270** for matches. If category **420** matches the search criteria, annotation software **170** displays thumbnails **1515** of the matched annotated WBDs **800** by following the pointer to thumbnail files **548** of the annotation records **500** linked to the associated list of annotation IDs **430**. Similarly, if user **200** wants to view all annotated WBD's **800** containing a specific ink-mark **810** (e.g., an asterisk or star), annotation software **170** receives the ink-mark **810** from user **200** through search interface **1600**, stores its graphical attributes in a temporary stroke record **6900** in temporary storage device **140**, and searches the stroke records **600** in stroke database **290** for matches. If stroke records **600** match the search criteria, annotation software **170** again displays thumbnails **1515** of the matched annotated WBDs **800** in Web browser **160**.

Sharing Annotations

The present invention also allows users **200** to send an annotated WBD **800** to someone else over the Internet **230**. By clicking on the send button on annotation toolbar **805**, user **200** can e-mail an annotated WBD **800** link to others so they can view annotated WBD **800** directly on their Web browser **160**, even if the others do not have annotation software **170**. In one embodiment, annotation software **170** creates a unique Internet address for annotated WBD **800** and inserts it into a draft of an e-mail. Annotation software **170** generates this address by executing a standard hash function on the contents of the annotated WBD **800** and stores it in URL content hash **520** of the associated anno-

tation record **500**. This address is mapped to the annotated WBD's **800** location in annotation database **280**. User **200** may then type a message in the e-mail, and send both the message and the link to someone else. When the recipient clicks on the link to view annotated WBD **800**, annotation repository **240** receives the request and sends annotated WBD **800** to the recipient's Web browser **160** for viewing. Annotated WBD **800** still contains its original active links and properties, and recipient does not need annotation software **170** installed to view annotated WBD **800**.

INTERFACE TECHNIQUES

The present invention provides users with many novel interface techniques. These techniques include using dog-ears and its associated navigation tools, splitting pages, turning pages, selecting and copying various portions of a WBD, and marking menus suited for right-handed or left-handed users **200**.

Gesture Recognition

Most of the interface techniques employed by the present invention involve gestures, which are strokes made by input device **120** that issue commands to Web browser **160**. The present invention utilizes three types of gestures:single stroke gestures, multi-stroke gestures, and dynamic gestures. Dynamic gestures refer to strokes that issue commands during the drawing of the stroke.

FIG. **17** is a flowchart of steps for recognizing gestures in accordance with an exemplary embodiment of the present invention. In this embodiment, a multi-stroke gesture comprises two strokes. The process starts when user **200** begins drawing a stroke with input device **120** in Web browser **160** (step **1700**). Annotation software **170** continuously monitors the stroke to determine when it has completed (step **1705**). During the drawing of the stroke ("no" branch of step **1705**), annotation software **170** determines whether a dynamic gesture is being employed through a process known eager recognition (step **1710**). If a dynamic stroke is recognized ("yes" branch of step **1710**), then annotation software **170** invokes the appropriate command to Web browser **160** (step **1715**) before resuming stroke monitoring. After the stroke is completed ("yes" branch of step **1705**), annotation software **170** builds a vector data matrix of the stroke features (e.g., number of direction changes, length of stroke, horizontal and vertical dot products, x and y positioning, time elapsed from start to end of stroke, and beginning and end points) in temporary storage device **140** (step **1720**).

Annotation software **170** recognizes a gesture by comparing the vector data matrix with recognizer objects, which are stored matrices associated with each multi-stroke and single stroke gesture utilized by annotation software **170**. Annotation software first compares the vector data matrix with its recognizer objects for single stroke gestures (step **1725**). If the stroke is recognized ("yes" branch of step **1725**), annotation software **170** invokes the appropriate command to Web browser **160** (step **1730**), and the process ends (step **1755**). If the stroke is not recognized as a single stroke gesture ("no" branch of step **1725**), annotation software **170** compares the vector data matrix with its recognizer objects for the initial stroke of multi-stroke gestures (step **1735**). If the initial stroke is recognized ("yes" branch of step **1735**), then annotation software **170** waits for the next stroke (step **1740**) and builds a corresponding vector data matrix of stroke features (step **1745**). Since this embodiment comprises two-stroke multi-stroke gestures, the next stroke is the final stroke of the multi-stroke gesture. If the final stroke is recognized ("yes" branch of step **1750**), then annotation software **170** invokes the appropriate command to Web browser **160** (step **1730**), and the process ends (step **1755**). If the initial stroke is not recognized as part of a multi-stroke gesture ("no" branch of step **1735**), or the final stroke is not recognized as part of a multi-stroke gesture ("no" branch of step **1750**), the process ends (step **1755**).

Dog-Ears

In the present invention, dog-ears provide a novel way to organize and index annotated WBDs **800** in a Web browser **160**. As shown in FIG. **18**, dog-ear **1800** marks annotated WBD **800** for later retrieval and resembles a folded corner of annotated WBD **800**. Users **200** may search through previously dog-eared annotated WBDs **800** by using the navigation widget **1900**, as shown in FIG. **19**. Each rectangle in navigation widget **1900** represents an annotated WBD **800**, and the annotated WBDs **800** with dog-ears **1800** have a small triangle to the right of their representative rectangle. As user **200** selects each rectangle in navigation widget **1900**, annotation software **170** displays a thumbnail **1515** of the associated annotated WBD **800** to the left of navigation widget **1900**, and displays the associated category **1520**, if it exists, above the thumbnail **1515**.

FIG. **20** is a flowchart of steps for creating, deleting, and navigating through dog-ears **1800** in accordance with an exemplary embodiment of the present invention. The method starts in step **2000**. If user **200** wishes to create a dog-ear **1800** ("yes"branch of step **2005**), user **200** issues a diagonal stroke gesture with input device **120** in the upper left-hand corner of the desired annotated WBD **800** (step **2010**). If user **200** chooses to navigate through existing dog-eared annotated WBDs **800** ("yes" branch of step **2015**), user **200** may utilize either navigation widget **1900** or input device **120** gestures. If user **200** chooses the navigation widget **1900** ("yes" branch of step **2020**), then user **200** selects the desired annotated WBD **800** identified by the small triangle (step **2025**), as shown in FIG. **19**. If user **200** chooses to use input device **120** gestures, then user **200** issues simple vertical strokes to view adjacent dog-eared annotation WBDs **800** (step **2030**), as shown in FIG. **21**. The circular end of the flip to dog-ear gesture representation in FIG. **21** denotes where input device **120** activates the stroke. For example, the left gesture representation in FIG. **21** comprising a downward stroke may issue the command to annotation software **170** to flip to the following dog-eared annotated WBD **800**, whereas the right gesture representation in FIG. **21** comprising an upward stroke may issue the command to annotation software **170** to flip to the previous dog-eared annotated WBD **800**. If user **200** decides to delete a dog-ear **1800** ("yes" branch of step **2035**), then user **200** repeats the diagonal stroke gesture of step **2010** (step **2040**). In another embodiment, the gesture in step **2040** could operate in the reverse direction (i.e, issue the diagonal stroke toward the upper left-hand corner of annotated WBD **800**).

One exemplary embodiment in accordance with the present invention uses the IE implementation of the DOM in combination with CSS and DHTML technology. When user **200** creates a dog-ear **1800** on annotated WBD **800** (step **2010**), annotation software **170** places a "true" value in the dog-ear **535** field of the associated annotation record **500**. When user **200** employs the navigation widget **1900** to select a dog-ear **1800** (step **2025**), annotation software places the small triangle denoting a dog-ear **1800** next to each rectangle associated with annotation records **500** with a "true" value in the dog-ear **535** field. When user **200** employs the flip to dog-ear gestures as shown in FIG. **21**, annotation software **170** searches forward or backward in annotation database **280** to select the annotation records **500** containing

a "true" value in the dog-ear **535** field. And when user **200** deletes a dog-ear **1800** from annotated WBD **800** (step **2040**), annotation software **170** places a "false" value in the dog-ear **535** field of the associated annotation record **500**.

Splitting Pages

The present invention employs novel page split gestures, as shown in FIG. **22**, that divide a WBD either horizontally or vertically. For example, the left gesture representation in FIG. **22** comprising a jagged horizontal stroke may issue the command to annotation software **170** to split a WBD horizontally, whereas the right gesture representation in FIG. **22** comprising a jagged vertical stroke may issue the command to annotation software **170** to split a WBD vertically. Annotation software **170** may use the IE implementation of the DOM in combination with CSS and DHTML technology to split the WBD using standard browser frame technology.

Turning Pages

The present invention employs novel single stroke and dynamic page turning gestures, as shown in FIG. **23** and FIG. **24**, that flip to the previously or subsequently viewed WBD. For example, the top gesture representation in FIG. **23** comprising a single left horizontal stroke may issue the command to annotation software **170** to flip to a previously viewed WBD, whereas the bottom gesture representation in FIG. **23** comprising a single right horizontal stroke may issue the command to annotation software **170** to flip to a subsequently viewed WBD. Annotation software **170** may turn the pages by using standard browser calls.

FIG. **25** is a flowchart of steps for turning multiple pages with a dynamic gesture in accordance with an exemplary embodiment of the present invention. In this embodiment, the pages of the WBD turn faster or slower depending upon the speed of user **200**'s circling input device **120**. A graphical representation of the dynamic gesture is illustrated in FIG. **24**. The method for using the dynamic gesture starts in step **2500**. User **200** first activates input device **120** in step **2510**. If input device **120** is a mouse in one embodiment, user **200** satisfies this step by left-clicking the mouse. If input device **120** is a pen or stylus, user **200** satisfies this step by touching the pen or stylus to the touch screen. User **200** then moves input device **120** in a circular pattern to turn to consecutive pages (step **2520**). Turning in a counterclockwise direction may flip to previous pages, whereas turning in a clockwise direction may flip to subsequent pages. If user **200** wants to turn pages faster or slower ("yes" branch of step **2530**), user **200** varies the speed of the circling motion accordingly (step **2540**). In other words, if user **200** wants to flip through pages faster, user **200** would increase the rotational speed of input device **120**. Alternatively, if user **200** wants to flip through pages slower, user **200** would decrease the rotational speed of input device **120**. When user **200** reaches the desired page, user **200** deactivates input device **120** (step **2550**). If input device **120** is a mouse, this is accomplished by user **200** releasing the click button. If input device **120** is a pen or stylus, this is accomplished by user **200** lifting the pen or stylus from the touch screen. This method ends in step **2560**.

Selecting Portions of Page

The present invention employs three novel selection gestures, as shown in FIG. **26**. The left gesture representation in FIG. **26** comprising a closed loop stroke may issue the command to annotation software **170** to select the area inside the loop. The middle gesture representation in FIG. **26** comprising a bracket stroke may issue the command to annotation software **170** to select the area bound by the bracket's three sides with no boundary on the fourth side. And the right gesture representation in FIG. **26** comprising two corner strokes issue the command to annotation software **170** to select the square area bound by the two edges. Annotation software **170** may use the IE implementation of the DOM in combination with CSS and DHTML technology to select these areas. Once the area is selected, user **200** may copy, move or paste the selection anywhere a typical graphical selection could be copied or pasted.

Shaking Out a Copy

The present invention employs a novel dynamic gesture that allows a selected area of a WBD to be copied by shaking it. FIG. **27** is a flowchart of steps for performing a shaking out a copy gesture in accordance with an exemplary embodiment of the present invention. The method starts in step **2700**. User **200** first uses input device **120** to select an object or area to be copied (step **2710**). While retaining selection of the object, user **200** shakes the selection back and forth with input device **120** to create a copy of the selection (step **2720**). Without deactivating input device **120**, which would deselect the object, user **200** drags the copy of the selection to the desired location (step **2730**). User **200** then deactivates input device **120**, leaving the copy of the selection in the desired area (step **2740**). The process ends in step **2750**. Annotation software **170** may use the IE implementation of the DOM in combination with CSS and DHTML technology to shake out the copy.

Right-Handedness and Left-Handedness of Marking Menus

The present invention employs a novel marking menu that can be arranged to suit the hand position of right-handed and left-handed users **200**. FIG. **28** illustrates a tap and dwell menu in accordance with a pen-based embodiment of the present invention. A standard marking menu **2810** can be summoned by any type of gesture, such as a double tap with the pen, a dwell with the pen (holding down the pen without lifting it) or a tap with the stylus button pressed. The regular marking menu **2810** then appears in the place the gesture was made, allowing user **200** to choose a menu item **2840***a*–**2840***d* without having to focus attention to another area of the screen as with traditional static menus. The menu items **2840***a*–**2840***d* are laid out radially rather than as a list, and allow imprecise picks. Once user **200** is familiar with the arrangement of the menu, it is easy to make a selection without even reading the menu, since user **200** only needs to know which direction to move the pen **2850** from the location of the gesture that summoned the menu. The marking menus of the present invention display menu items **2840***a*–**2840***d* in the area that is most visible to user **200**, taking into account the positioning of user **200**'s hand. For instance, a right-handed user **200** would use the right handed marking menu **2820**, whereas a left-handed user **200** would use the left handed marking menu **2830**.

Several embodiments of the present invention are specifically illustrated and/or described herein. However, it will be appreciated that modifications and variations of the present invention are covered by the teachings and within the purview of the appended claims without departing from the spirit and intended scope of the present invention.

What is claimed is:

1. A method for annotating a Web-based document and viewing the annotated document, comprising the steps of:

(a) generating annotation data by processing first user input provided to annotation client software by a first user of the annotation client software;

(b) associating the annotation data with the document to create the annotated document, the document being displayed via a Web browser;

(c) providing the annotated document to an annotation server;

(d) with the annotation server, generating a graphic data file corresponding to a visual layout of the annotation data;

(e) when a second user of the annotation client software attempts to view the annotated document, generating the annotated document for the second user as a function of the document and the associated annotation data including

(i) enclosing the annotated document inside a fixed-sized layer of the Web browser,

(ii) examining each element of the annotated document to detect particular properties which cause the element to move relative to a predetermined corner of the annotated document during resizing of the Web browser, and

(iii) modifying the particular properties to prevent such movements;

(f) when a third user not employing the annotation client software attempts to view the annotated document, generating the annotated document and providing the annotated document to the third user as a function of the document, the graphic data and predetermined programming codes; and

(g) before step a, preventing elements of the document from moving when the document is being one of resized and manipulated.

2. The method according to claim **1**, wherein the annotation data includes at least one of ink marks, highlight marks, text-based note windows and audio dictations.

3. The method according to claim **1**, wherein the document is a blank document.

4. The method according to claim **1**, wherein the predetermined corner is a top left corner of the document.

5. The method according to claim **1**, wherein each of steps (b) and (e) includes the sub-step of utilizing at least one ActiveX control to draw ink images and text-based note windows over the document based on the annotated data.

6. A method wherein the graphical data file situated on a top of the annotated document is transparent in every location of the annotated document except locations which include ink marks, for annotating a Web-based document and viewing the annotated document, comprising the steps of:

(a) generating annotation data by processing user input provided to annotation client software by a first user of the annotation client software;

(b) associating the annotation data with the document to create the annotated document, the document being displayed via a Web browser;

(c) providing the annotated document to an annotation server;

(d) with the annotation server, generating a graphic data file corresponding to a visual layout of the annotation data;

(e) when a second user of the annotation client software attempts to view the annotated document generating the annotated document for the second user as a function of the document and the associated annotation data; and

(f) when a third user not employing the annotation client software attempts to view the annotated document, generating the annotated document and providing the annotated document to the third user as a function of the document, the graphic data and predetermined programming codes, and wherein step (f) further includes the substeps of:

(i) inserting a further layer into the document to overlay each text-based note window of the annotated document,

(ii) overlaying four identical copies of the graphical data file on top of the annotated document, and

(iii) changing clipping rectangles of the four identical copies in response to the user input to provide proper passage of the user input to the annotated document.

* * * * *