United States Patent [19]

Wexelblat et al.

[11] **Patent Number: 5,021,976**

[45] **Date of Patent: Jun. 4, 1991**

[54] **METHOD AND SYSTEM FOR GENERATING DYNAMIC, INTERACTIVE VISUAL REPRESENTATIONS OF INFORMATION STRUCTURES WITHIN A COMPUTER**

[75] Inventors: **Alan D. Wexelblat; Kim M. Fairchild,** both of Austin, Tex.

[73] Assignee: **Microelectronics and Computer Technology Corporation,** Austin, Tex.

[21] Appl. No.: **271,091**

[22] Filed: **Nov. 14, 1988**

[51] **Int. Cl.**[5] **G06F 3/153**

[52] **U.S. Cl.** **364/521;** 364/518; 364/146; 340/747

[58] **Field of Search** 364/518, 521, 522, 146, 364/141; 340/721, 723, 747, 750, 798-800

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,752,893	6/1988	Guttag et al.	364/521 X
4,772,882	9/1988	Mical	364/521 X
4,813,013	3/1989	Dunn	364/521 X
4,814,755	3/1989	Johnson et al.	364/521 X
4,823,283	4/1989	Diehm et al.	364/518

OTHER PUBLICATIONS

Steamer: An Interactive Inspectable Simulation-Based Training System, by James D. Hollan, Edwin L. Hutchins and Louis M. Weitzman, dated 1984.

"Direct Manipulation Interfaces", by Edwin L. Hutchins, James D. Hollan and Donald A. Norman, Human-Computer Interaction, 1985, vol. I, pp. 311-338.

"Graphic Interfaces for Simulation", Advances in Man-Machine Systems Research, vol. 3, pp. 129-163 (JAI Press, Inc. 1987).

"SemNet: Three-Dimensional Graphic Representations of Large Knowledge Bases", *Cognitive Science and Its Applications for Human Computer Interaction,* Kim Fairchild, S. Poltrock and G. P. Furnas, Lawrence Erlbaum Associates, 1987.

"Picture Generation Using Semantic Nets", R. D. Giustini, M. D. Levine, and A. S. Malowany, Computer Graphics and Image Processing, vol. 7, pp. 1-29, Academic Press, Inc., 1978.

"Human Factors in Data Access", T. K. Landauer, S. T. Dumais, L. M. Gomez and G. W. Furnas, Bell System Technical Journal, vol. 61, No. 9, Nov. 1982.

"Generalized Fisheye Views", G. W. Furnas, *Human Factors in Computing Systems,* Apr. 1986.

"The Alternate Reality Kit", Randall B. Smith, 1986 *IEEE Computer Society Workshop on Visual Languages,* Jun. 1986.

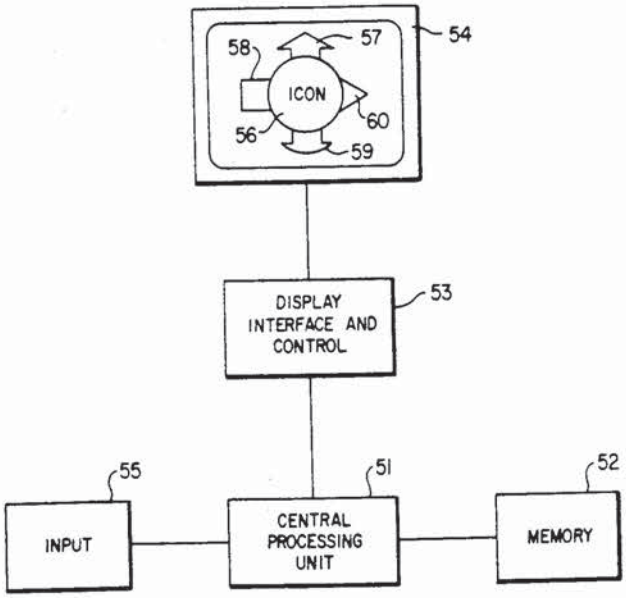
Primary Examiner—Heather R. Herndon

Attorney, Agent, or Firm—Johnson & Gibbs

[57] **ABSTRACT**

A method and system for generating dynamic, interactive visual representations of information structures within a computer which enable humans to efficiently process vast amounts of information. The boundaries of the information system containing the information to be processed are established and a set of mathematical relationships is provided which indicates the degree of correlation between parameters of interest to a user and segments of information contained within the boundaries. A visual display is generated for the user which has a plurality of different iconic representations and visual features corresponding to the parameters defined by the mathematical relationships. The iconic representations and visual features of the visual display change with the movement of the mathematical relationships within the boundaries of the information system according to the degree of correlation between the parameters of interest and the segment of information through which the mathematical relationships are passing.

30 Claims, 3 Drawing Sheets



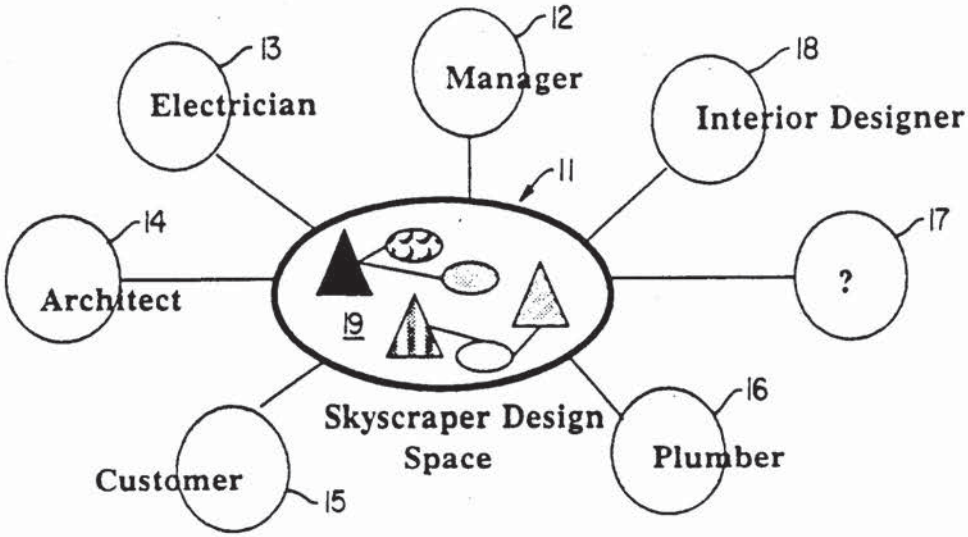


FIG. 1

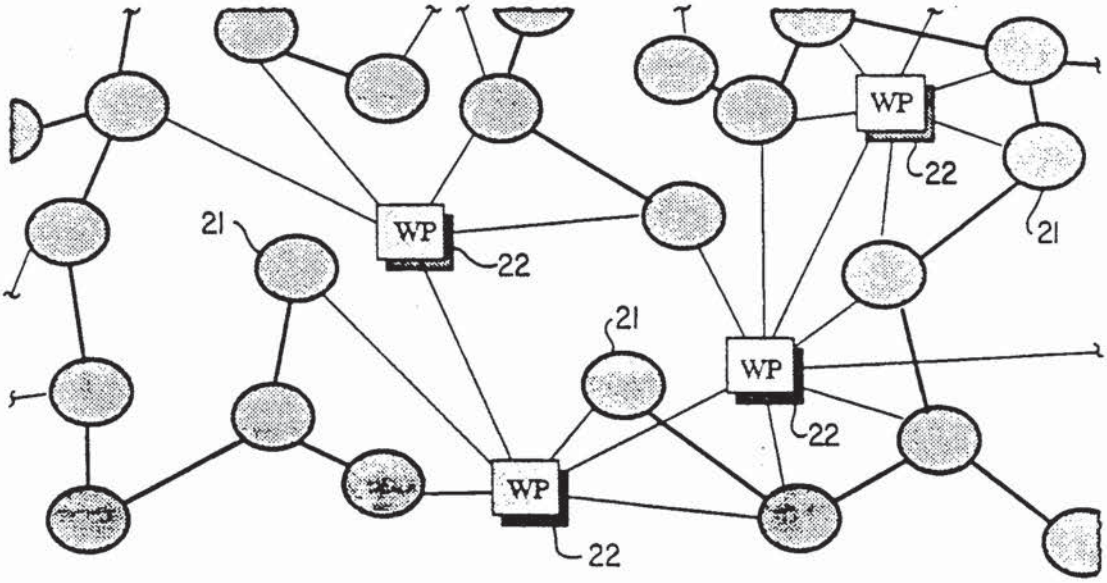


FIG. 2

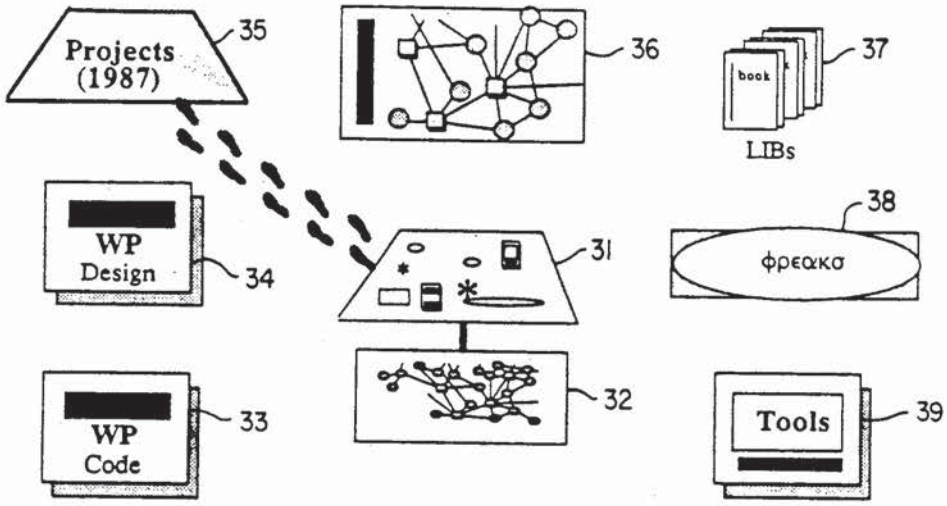


FIG. 3

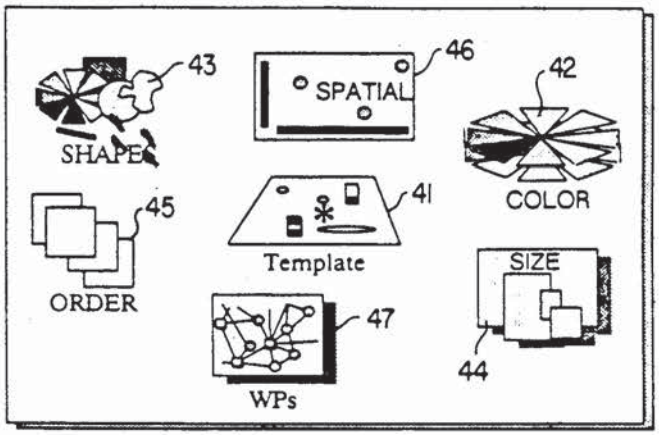


FIG. 4

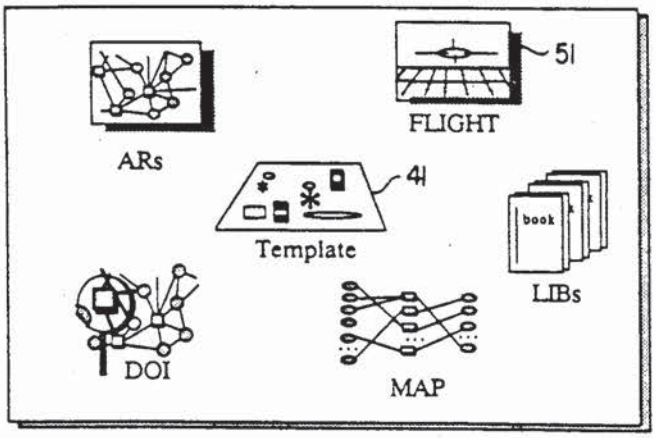


FIG. 5

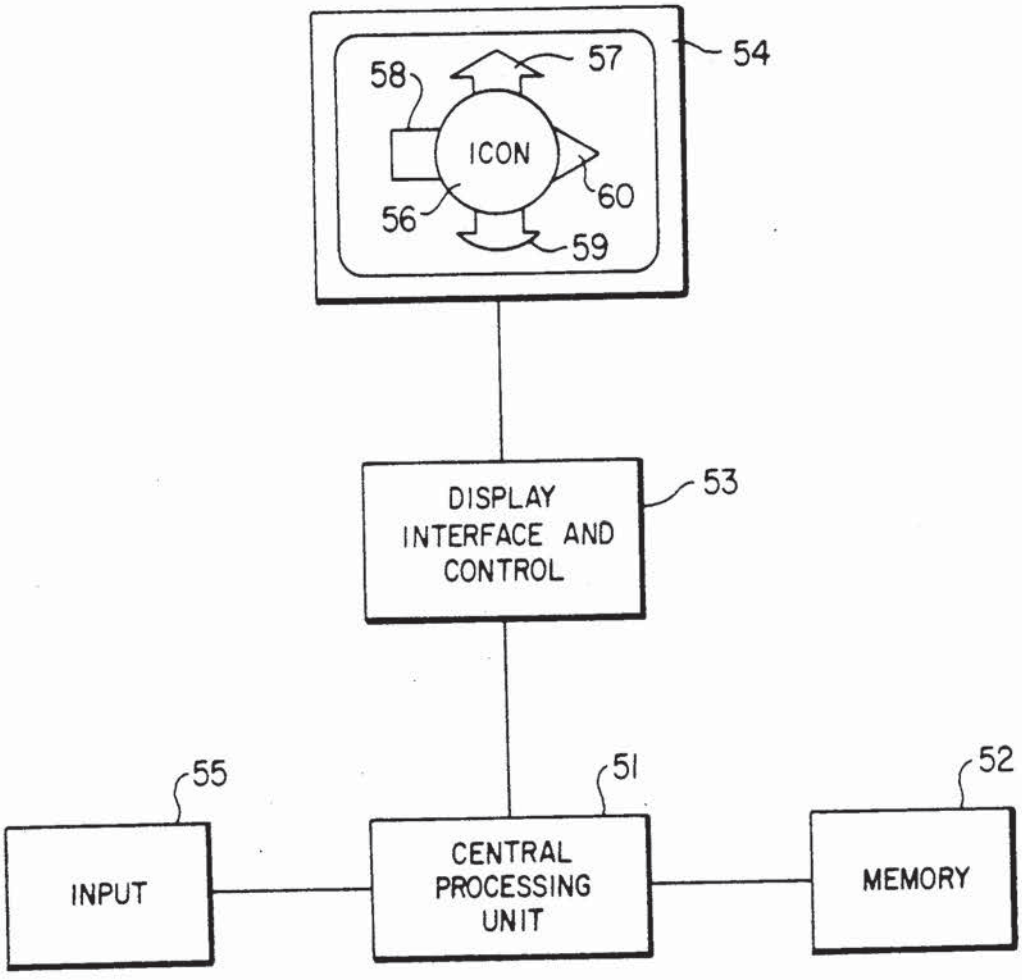


FIG. 6

METHOD AND SYSTEM FOR GENERATING DYNAMIC, INTERACTIVE VISUAL REPRESENTATIONS OF INFORMATION STRUCTURES WITHIN A COMPUTER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to human interface with information systems, and, more particularly, to a computer system for inspecting and modifying data contained within an information system.

2. History of the Prior Art

Two results of the rapid increase in available facilities with huge capacities for data storage and with enhanced speeds for manipulating data are the accumulation of vast complexes of information spaces and the interconnection of networks of such spaces. The term "semantic network" is used herein for a set of information organized along a particular conceptual line, while the term "cyberspace" is used herein for a large pool of complex information organized along virtually every conceptual line that can be thought of. One of the problems associated with such huge cyberspaces is how to determine optimum ways for human operators to interact with meaningful subsets of information contained within a cyberspace. Although humans are wonderful cognitive processors of information, they rapidly become saturated and ineffectual when confronted with too much information at one time.

In the management and use of large cyberspaces of information, the principal human problem is how to enable people to navigate through the information space focusing on specific information without losing their awareness of information at the global level. More particularly, there is the problem of how to enable a user to interact efficiently with the information contained in a large information system. A user must be able to rapidly inspect, select, and modify data within a system if this data is to be widely and effectively used.

While highly skilled programmers and other such users may be able to meaningfully interpret lines of code on a display screen, most users cannot. For this reason, application programs have often incorporated various types of graphical displays to communicate information about the internal condition and operation of the information system. Such graphical display interface systems enable the user to make program selections and provide other input related to the information processing activity. One particularly useful tool for interfacing with an information system has been the graphical symbols called "icons."

An icon is a small pictorial representation of some larger set of information. Icons have been used for many years as a way to graphically indicate certain information about the contents of a system or state of operation. Generally, icons fit into one of two categories:static or dynamic. A static icon is simply a picture of something that indicates a condition within a computer system. For example, it could be an image of a window within a windowing system, which has been closed down and put into the background of the display. Alternatively, it could be a picture of an unopened document in a word processor type of information system. Overall, it is a simple, static picture on a display screen, connoting certain encoded information in the mind of a human operator.

A second kind of icon employed in the past is also in the static category, although it incorporates a certain amount of dynamism. This dynamism reflects a certain activity in the information or in the condition of the system represented by the icon. For example, one icon employed in a windowing system appears when a window is closed as a shrunken representation of the window. If some new text appears in the window while it is closed down, the text is also represented in the icon, but in a proportionally smaller size. That is, some additional information appears in the icon when changes occur in the system, but that information is treated as a change going on in the background, to which the operator is paying little attention.

A related type of icon, which is basically static but which incorporates a certain amount of dynamism, is the animated icon. For example, in one application program, a trash can grows in size as the user discards files without emptying the trashcan's contents. While only three actual sizes of icons are used—a normal slim size, an intermediate size, and a very full size—they are displayed sequentially to connote growth to the user. Each of the individual graphical images comprising the animated icon is static in that it is fixed in size; the composite appears to move only as the result of an animated illusion.

Highly sophisticated animated icons have also been used to provide graphical interfaces for computer simulations of complex physical systems. By way of illustration, numerous editorially selectable animated icons are used in the interactive, inspectable, simulation-based instructional steam power plant system described in "Graphic Interfaces for Simulation," *Advances in Man-Machine Systems Research*, Vol. 3, pp. 129–163 (JAI Press, Inc. 1987). Each of these icons is directly connected to respond to an associated variable within the mathematical simulation algorithm to indicate the existence of particular conditions within the simulated physical system.

The icon is an extremely useful tool because it is designed to trigger within the mind of the human operator concepts that quickly communicate the contents or operation of the information system. Most icons are either static or animated and are connected so that they respond directly to either an information system condition or a variable within a simulation algorithm. If an icon could instead be coupled to a means for moving through and inspecting the contents of an information system and graphically depicting the results of that inspection, it could be used to great advantage in communicating information about large cyberspaces of information. The present invention proposes such an automatically generated icon system for enabling a user to interface with data contained within an information system.

SUMMARY OF THE INVENTION

The system of the present invention includes the definition of mathematical relationships that are movable within an information space. The system also defines a means for relating to that information space in accordance with a set of criteria delineating a plurality of parameters that are of potential interest to a user. An automatic icon is defined by associating certain graphical primitives with certain mathematical relationships so that as an embodiment of the relationships are moved through an information space, the appearance of the icon automatically changes as a result of the correlation

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.