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Luciw

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[54] METHOD AND APPARATUS FOR PROCESSING NATURAL LANGUAGE

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 889,225, May 27, 1992, Pat. No. 5,390,281, and Ser. No. 99,861, Jul. 30, 1993.

[51] Int. Cl.⁶ **G06F 15/38; G06G 7/60**

[52] U.S. Cl. **364/419.13; 364/419.08; 364/419.11; 395/10; 395/12; 395/51; 395/54; 395/60; 395/62**

[58] Field of Search **364/419.01, 419.08, 364/419.1, 419.11, 419.12, 419.13; 395/10, 12, 50, 51, 54, 60, 62, 63, 75, 76, 77**

[56] References Cited

U.S. PATENT DOCUMENTS

4,670,848	6/1987	Schramm	395/60
4,713,775	12/1987	Scott et al.	395/50
4,736,296	4/1988	Katayama et al.	364/419.08
4,750,122	6/1988	Kaji et al.	364/419.13
4,785,413	11/1988	Atsumi	364/419.13
4,875,187	10/1989	Smith	395/141
4,887,212	12/1989	Zamora et al.	364/419.08
4,918,723	4/1990	Iggulden et al.	379/100
4,945,504	7/1990	Nakama et al.	364/709
4,953,106	8/1990	Gansner et al.	395/160
4,974,191	11/1990	Amirghodsi	395/275
4,994,966	2/1991	Hutchins	364/419.08
5,091,790	2/1992	Silverberg	358/434

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

0441089A2	8/1991	European Pat. Off.	3/23
932164	5/1989	Japan	.

OTHER PUBLICATIONS

Microsoft MSDOS Operating System User's Guide; pp. 4-1 to 4-16, 5-1 to 5-19; 1982; 1983.

O'Connor, Rory J., "Apple Banking on Newton's Brain", San Jose Mercury News, Apr. 22, 1991.

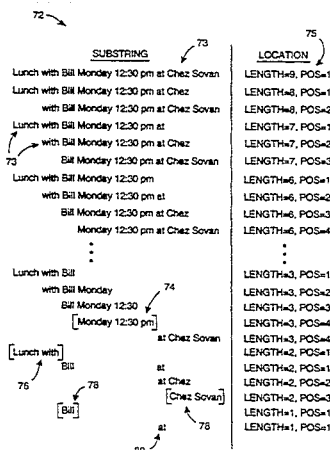
Hendrix, Gary G. and Walter, Brett A., "The Intelli-
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[57] ABSTRACT

A method and apparatus for processing natural language and deducing meaning from a natural language input characterized by the steps of (a) receiving an ordered string of word objects having a natural language meaning, (b) selecting a word window length, and (c) successively moving the word window along the ordered string and analyzing the meaning of a substring of word objects that fall within the word window. The substring is removed from the ordered string if the substring has a recognized meaning, until all substrings of the ordered string that fit within the window have been analyzed. In a step (d), the word window length is reduced and step (c) is repeated until only an unrecognized residual of the ordered string remains. The meaning of the substring is analyzed by mapping the substring against a database using one or more mapping routines. The mapping routines are preferably arranged in a hierarchy, wherein a successive mapping routine is used to analyze the substring when a previous mapping routine in the hierarchy cannot map the substring. A computer-implemented task is determined from the recognized substrings and performed by the computer system. The apparatus of the present invention implements the method on a pen-based computer system, and the ordered string is preferably received from strokes entered by a stylus on a display screen of the pen-based computer or from a microphone receiving speech input.

27 Claims, 12 Drawing Sheets



U.S. PATENT DOCUMENTS

5,103,498	4/1992	Lanier et al.	395/68
5,109,509	4/1992	Kayatama et al.	395/600
5,123,103	6/1992	Ohtaki et al.	395/600
5,282,265	1/1994	Rohra Suda et al.	395/12
5,327,342	7/1994	Roy	364/419.1
5,357,431	10/1994	Nakada et al.	364/419.13

OTHER PUBLICATIONS

gent Assistant: Technical Considerations Involved in Designing Q&A's Natural-Language Interface," Byte Magazine, Dec. 1987, Issue 14, p. 25.

Edwards, John R., "Q&A: Integrated Software with Macros and an Intelligent Assistant," Byte Magazine, Jan. 1986, V. 11, Issue 1, pp. 120-122.

Goldberg, Cheryl, "IBM Drawing Assistant: Graphics for the EGA," PC Magazine, Dec. 24, 1985, vol. 4, Issue 26, p. 255.

Garretson, R., "IBM Adds 'Drawing Assistant Design Tool to Graphic Series," PC Week, Aug. 13, 1985, V. 2, Issue 32, p. 8.

Glinert-Stevens, Susan, "Microsoft Publisher: Desktop Wizardry," PC Sources, Feb. 1992, V. 3, Issue 2, p. 357.

Nilsson, B. A. "Microsoft Publisher is an Honorable Start for DTP Beginners," Computer Shopper, Feb. 1992, V. 12, Issue 2, p. 416.

Poor, Alfred, "Microsoft Publisher," PC Magazine, Nov. 26, 1991, V. 10, Issue 20, p. 40.

Rampe, Dan et al., Jan. 9, 1989 news release, Claris Corp. (announced "SmartForm Designer" and "SmartForm Assistant").

Berry, Deanne et al., Apr. 10, 1990 news release, Symantec, (announced new version of MORE™).

Elofson, G. et al., "Delegation Technologies: Environmental Scanning with Intelligent Agents," Jour. of Management Info. Systems, Summer 1991, V. 8, Issue 1, pp. 37-62.

Nadoli, Gajanana et al., "Intelligent Agents in the Simulation of Manufacturing Systems," Proceedings of the SCS Multiconference on AI and Simulation, 1989.

Sharif Heger et al., "KNOWBOT: An Adaptive Data Base Interface," Nuclear Science and Engineering, Feb. 1991, V. 107, No. 2, pp. 142-157.

Ohsawa, I. et al., "A Computational Model of an Intelligent Agent Who Talks with a Person," Research Reports on Information Sciences, Series C, Apr. 1989, No. 92, pp. 1-18.

Ratcliffe, Mitch et al., "Intelligent Agents Take U.S. Bows," MacWeek, Mar. 2, 1992, V. 6, No. 9, p. 1.

Boy, Guy A., Intelligent Assistant Systems, Harcourt Brace Jovanovicy, 1991.

"Microsoft Windows User's Guide for the Windows Graphical Environment," version 3.0, Microsoft Press, copyright 1985-1990, pp. 33-41 & 70-74.

R. Wilensky et al., "Talking to UNIX in English: an Overview of UC," Communications of the ACM, Jun. 1984, vol. 27, No. 6.

Tello, Ernest R., "Natural-Language Systems," Mastering AI Tools and Techniques, Howard W. Sams & Company, 1988.

Knight, Kevin, & Rich, Elaine, "Heuristic Search," Production Systems, Artificial Intelligence, 2nd ed., McGraw-Hill, Inc., 1983-1991.

Miastkowski, Stan, "PaperWorks Makes Paper Intelligent," Byte Magazine, Jun. 1992.

Dickinson et al., "Palmtops: Tiny Containers for All Your Data," PC Magazine, Mar. 1990, vol. 9, p. 218(3).

Bajarin, Tim, "With Low End Launched, Apple Turns to Portable Future," PC Week, Oct. 1990, vol. 7, p. 153(1).

Corporate Ladder, BLOC Publishing Corp., 1991.

Diagrammaker, Action Software, 1989.

Diagram-Master, Ashton-Tate, 1989.

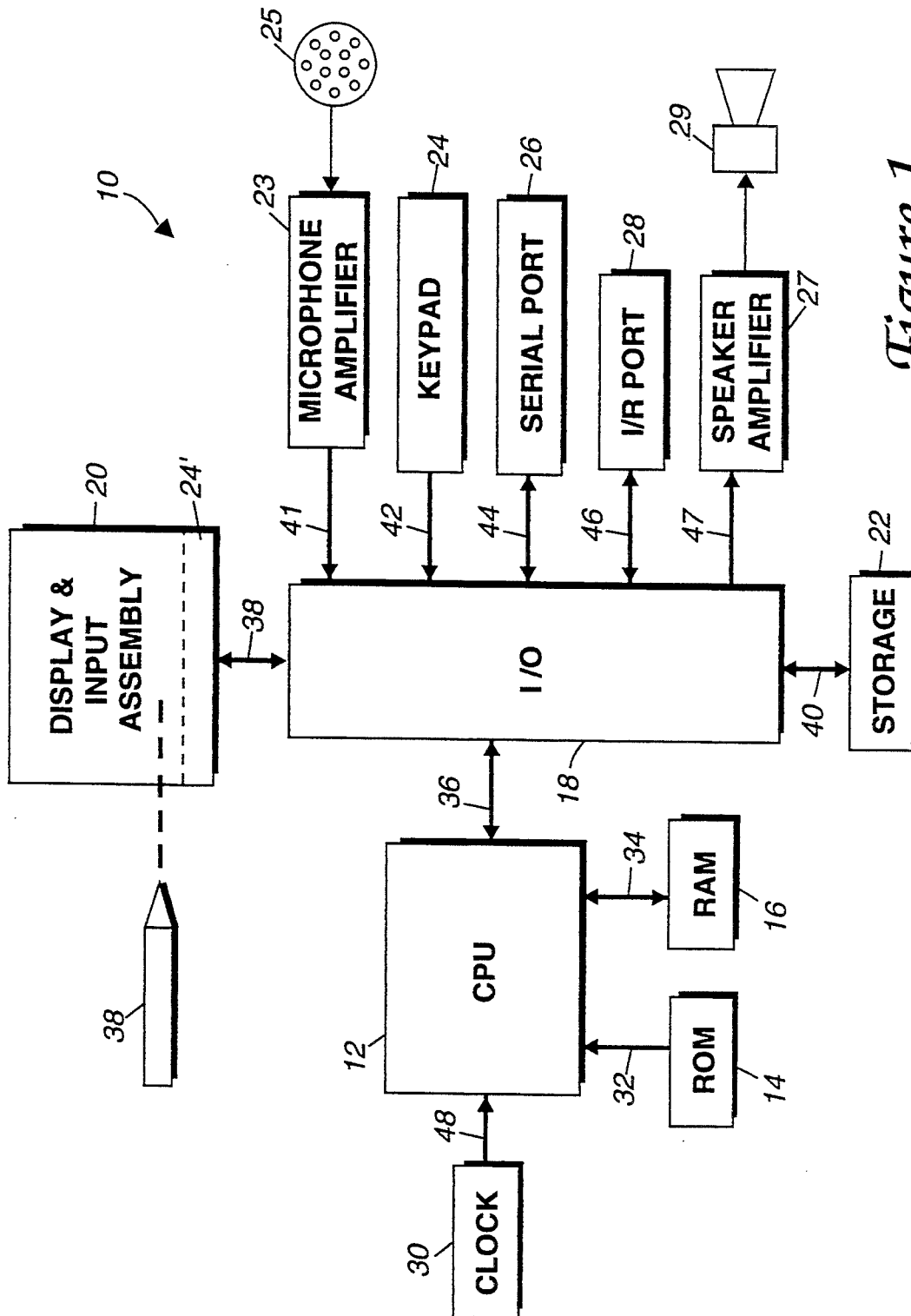


Figure 1

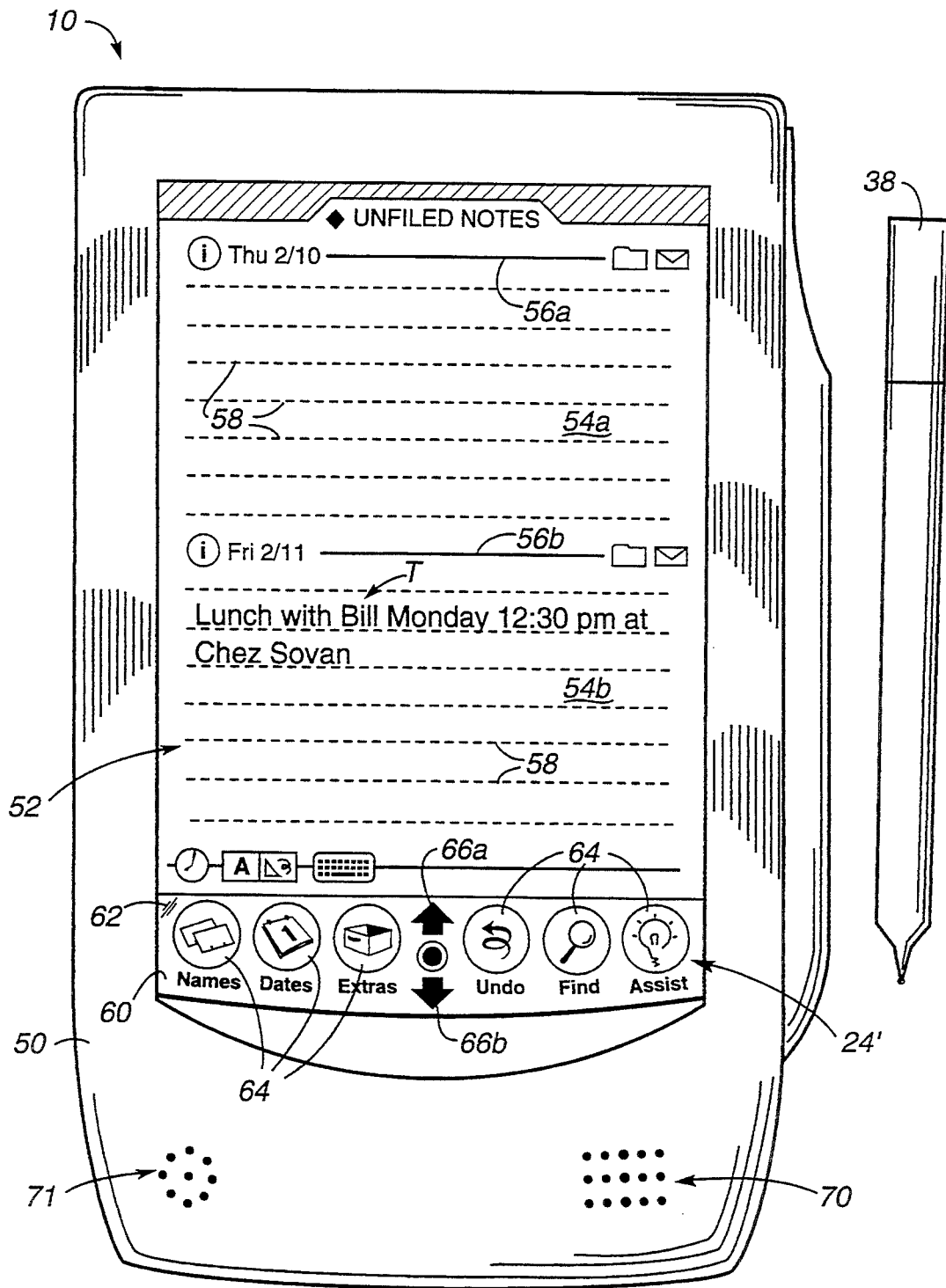


Figure 2

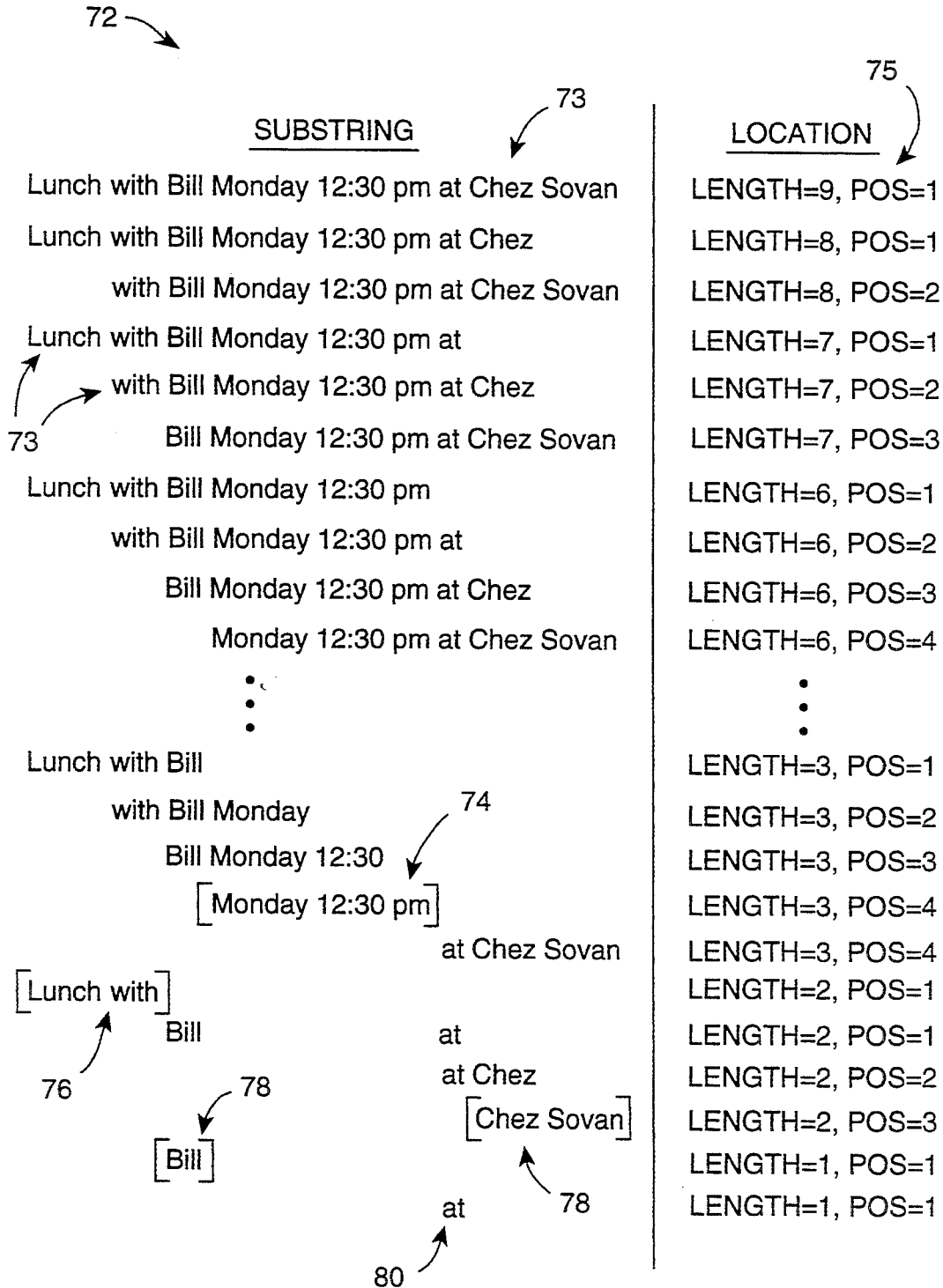


Figure 3

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