The result of implementing this user interface is a MEDSAFE system which is quite easy to learn and to operate, even for those individuals with no understanding of computers, and no experience as a computer operator. Constructing such a system out of existing software packages (even if such packages existed for all of MEDSAFE's functions) would result in a less satisfactory implementation, as the user interface and 'concept-ofoperation' would likely be different for each package.



Figure 3. Example Display Screen Sequence.

Storage and Backup: Such a system must provide storage sufficient for thousands of patients, a reliable, simple, and rapid method for creating back-up copies of data, and be able to expand to accommodate future needs.

MEDSAFE is a closely-integrated structure based on a specially-designed microcomputer which provides sophisticated storage capabilities. It has an on-line storage capacity of over 25,000,000 characters, and can back-up or restore this entire data set using a cartridge tape in under ten minutes.

The MEDSAFE storage sub-system consists of one Winchester-type 8"-form-factor disc drive with a 35megabyte (unformatted) storage capacity, a streaming-type cattridge tape drive, which uses ANSI-standard 1/4" cattridges and has a capacity of 20 megabytes per cattridge, a single controller which operates both storage devices, and a custom-designed host interface which resides inside of the terminal unit.

The backup and restore software is designed so that both patient medical and accounting data is backed-up onto one single tape cartridge. The software, drug data base, and drug interaction records are backed-up onto a separate cartridge. This allows the user to frequently back-up his patient data without having to always take the additional time to back-up the relatively static portions of the system.

The storage sub-system can be readily expanded by the addition of more disc drives. Currently, the maximum number of drives which can be supported is four. In addition, plug-compatible drives which have storage capacities larger than 35 megabytes are becoming available.

<u>Performance rates</u>: Despite having over 30,000 drugs in its data base, it is necessary that response times be short and consistent. MEDSAFE requires a maximum of five to ten seconds to perform a complete drug interaction analysis on a set of several drugs. It can also call-up and display any portion of any patient's medical or accounting record in 1 to 3 seconds. This performance level is achieved through the use of an indexing scheme which minimizes the amount of linear searching required.

Remote Access: In ordet to service the needs of the physician 'on-call', it is desitable for such a system to provide an economical way for the physician to get access to the data in his system from remote locations, such as the physician's home, or from the emergency room at a local hospital.

MEDSAFE provides remote access to all of its services, to remote sites of the user's own choosing. This is accomplished by means of a remote terminal (a duplicate of the terminal unit in the office) which gives the user 24-hour access to the MEDSAFE system. The system includes the necessary 1200-baud modems and all cabling.

Hard Copy: The system must be capable of producing permanent copies of patient records, drug interaction analyses, and so forth, as well as printing bills and accounting records. MEDSAFE provides a spooled printer function, so that these activities can take place without preventing the system from continuing with other operations while printing is taking place. The widelyused Centronics-type parallel interface is implemented, allowing a wide variety of printers to be employed. A bi-directional dot-matrix printer capable of printing over 100 characters per second is supplied with the system. Updates to the Drug and Interaction Data Bases: New drugs are continually being introduced, and new interactions are continually being discovered. Therefore, it is vital that the drug and interaction data base be periodically updated. An unmaintained data base would quickly become obsolete.

The data base employed in MEDSAFE was developed (in association with the Division of Adverse Effects of the FDA) by Medicare-Glaser Corporation of St. Louis, a major pharmacy firm, which itself uses the data base in its own computerized pharmacy system. The data base currently contains over 30,000 drugs and their interaction patterns. A team of physicians and pharmacologists regularly review the clinical literature in order to identify new interactions which should be included into the data base.

Copies of standard reference works (the <u>Evaluation</u> of <u>Drug Interactions</u>, and its supplement) are provided with each system. A folder which describes interactions too new for inclusion into the EDI and its supplement is also provided. MEDSAFE gives a reference (to the page) for every analysis result. The data base and the reference documents are updated quarterly by COMPUNET. Figure 4 shows an example interaction analysis result.



Figure 4. Example Interaction Result.

Security: Such a system must be secure, and capable of preventing unauthorized use.

MEDSAFE has a built-in security system. Multi-level passwords limit display or change of the drug interaction data base and patient medical records to authorized users. There can be up to sixteen separate protection classes (e.g., read medical records, change medical records, read accounting records, change accounting records, enable remote processing, grant remote access, view the current passwords, and so forth), and the user can set passwords to control each class, or any combination of classes.

<u>Multi-user</u>: Larger group practices, clinics, and other sizeable organizations may require more than one operator station.

MEDSAFE can also be configured as a multi-station system, with up to six terminals units being supported by a single storage unit, with no change in performance as compared to the single-station configuration. This configuration can also support multiple printers (which can be of varying types) and multiple remote terminals.

This is accomplished by providing the ability for the storage unit to share data among the terminal units. Each terminal unit provides its own high-speed memory and performs all of its own computations; only the data storage and access resources are shared. Because the access times and input/output bandwidth of the MEDSAFE storage unit are many times higher than is required by any one terminal unit, each terminal in a multi-station configuration can operate at a performance rate comparable to the single-user system.

COMPUNET's design of the MEDSAFE system is oriented around data access at the record level. Hence, the addition of record-level access sychronization controls permits multiple stations to gain access to disjoint portions of the same data file simultaneously. This is implemented by the addition of the following to create a multi-station system:

- adding a "file server" processor to the storage unit, which performs the data access, sychronization (i.e., "locks" and "unlocks"), and distribution of data in a multi-tasking environment.
- removing the direct disc-access routines from the terminal unit software, and replacing with remote disc-access routines.

The multi-station version of MEDSAFE is intended to support larger group practices, non-pharmacy hospital applications, and large public and private medical clinics. The stations could each be separated from the storage unit by up to one kilometer.

Summary: A system has been described which provides a single, powerful tool for directing the latest techniques of automation at the goal of improving patient care, by providing a unique combination of services in one unified, cohesive package. Particularly important is the system's capability to rapidly and reliably identify potentially adverse drug interactions. The availability of such a tool will allow physicians to confidently expand the repertoire of drugs which they prescribe. Microprocessor technology brings this function for the first time into a price range accessible to individual practices.

By a novel and innovative application of microprocessor hardware technology and software development methodology, a system has been developed which breaks new ground for medical microcomputer systems in many key areas, such as storage capacity, the logistics of data back-up, ease-of-learning and ease-ofuse, remote access, and comprehensibility of the displays.



MEDSAFE is a trademark of COMPUNET, Incorporated

Canadian Secretariat The International Society for Mini and Microcomputers - ISMM P.O.Box 25, Stn.G Calgary, Alberta, Canada T3A 2G1 Tel.286-1589 Telex: 038-26670

April 28, 1982

NEIL SIEGEL PRINCIPAL SCIENTIST COMPUNET, INC. 11222 LA CIENEGA BLVD. SU. 570 INGLEWOOD, CAL, 90304

Dear Sir/Madame

It gives me pleasure to inform you that based upon the abstract we have received, your paper:

Paper No.: C1-024 Entitled: Identifying adverse drug interactions: a unified approach to automation in the doctor's office. By: Dr. N. Siegel (USA)

has been accepted for presentation at the ISMM International Symposium, Mini and Micromputers and their Applications, MIMI'82 Cambridge, to be held at the Hyatt Regency Hotel, Cambridge, Mass., July 7 to July 9, 1982. Enclosed are special forms for the preparat of your manuscript. Your paper will be reviewed for possible publication in the ISMM 'International Journal of Mini and Microcomputers'. Please supply us with a letter confirming your attendance.

Yours sincerely

m. Hany

M.H.Hamza Member I.P.C.

P.S.

- 1: All slides and viewgraphs must be easy to read, please take great care in their preparation.
- Authors must register and papers must be received prior to presentation.
- 3. Papers not presented at the symposium will not be published.
- 4. The preliminary program shall be mailed May 15, 1982.

Canadian Secretariat The International Society for Mini and Microcomputers - ISMM P.O.Box 25, Stn.G Calgary, Alberta, Canada T3A 2G1 Tel.286-1589 Telex: 038-26670

April 23, 1982

NEIL SIEGEL COMPUNET, 11222 LA CIENEGA BLV SUITE 570/575 INGLEWOOD, CA 90304 U.S.A.

#### DEAR SIR/MADAME

It gives me pleasure to inform you that based upon the abstract we have received, your paper:

Code: P2-004 Entitled: Identifying adverse drug interactions: a unified approach to automation in the doctor's office By: Neil Siegel (USA)

has been accepted for presentation at the ISMM International Symposium, Mini and Micromputers and their Application, MIMI'82, to be held at the Sheraton Hotel in Paris June 29 to July 2, 1982. Enclosed are special forms for the preparation of your manuscript. Your paper will be reviewed for possible publication in the ISMM 'International Journal of Mini and Microcomputers.' Please supply us with a letter confirming your attendance.

Yours sincerely

m. Hamp

M.H.Hamza Member I.P.C.

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# PRELIMINARY PROGRAM

# Twentieth ISMM International Symposium



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verification system - K. Kamel, T. A.K. Bejezyholt (USA) California Inst. of Technology C.S. Chen recognition telephone did The University of Akron, Ohio K.L. Doty m Steller Cognian, RUniversity of Florida, Gamesville B. Puhrtssni, A.P. Cavallergau (USA) M.H. Hamzaon up syntactic approach. The University of Calgary, Canada J.L. Houle Bolytechnique Montreal, Canada P.L. Hsu motion and classification MeDonnell Douglas Astronautics Company R.A. Kenned V G Wee (USA) G.K.P. Lee Colorado State University, Fort Collins D. Moldovan University of Southern California C.P. Neuman (CANADA) J.R. Purvis III meccoprogram able of Texas Instruments Inc. Austin M.A. Soderstrand Hoo-min Toong

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A fast real-time microprocessor based identification algorithm - R. Doraiswami, M.S. Wood (CANADA)

An efficient algorithm for unmodified ARMA spectral estimation - K. Ogino (USA)

#### 13:45 TUTORIAL

Wide area data gathering systems -J.A. Kleppe (USA)

#### 14:30 APPLICATIONS 3 Chairman: N.M. Schmitt (USA)

A microprocessor based indirect blood pressure instrument based on ultrasound - C.G. Hutchens (USA) On-line measurement and interpretation of three-axis goniometer diagnostic studies - N. M. Schmitt, R.M. Tafreshi, J. Arnold (USA)

Identifying adverse drug interactions: a unified approach to automation in the doctor's office - N. Siegel (USA) Direct architectural emulation of systolic organizations - I.R. Greenshields, P.M. Ibsen (USA)

#### 17:00 CLOSING REMARKS

#### SOCIAL PROGRAM

#### Tour I

Introduction to Boston

This tour gives the visitor an insight into old Boston from Beacon Hill and the North End to the Prudential Complex and Government Center of the new Boston. Many of the Freedom Trail sites will be covered as the old world charm of the past blends with the exciting architecture of the present.

A stop will be made at the Old

North Church of Paul Revere fame. A short history of the events that led to the Revolution will be heard at the church. This tour will end at Faneuil Hall Marketplace, one of the most exciting restorations in America. Price: \$10 (min. 30 persons).

Duration: 3 hours, evening July 7.

#### Tour II

North Shore Dinner Tour

This colourful North Shore area (about 40 miles from Boston) gives the visitor an opportunity to see the rugged rock-bound coastline of New England. The granite quarries here provided the cornerstones of some of Boston's most beautiful buildings.

Rockport, a well known art colony is situated on the streets where Alexander Bell once sold stock in his transatlantic cable. This area is a mecca for those whose tastes vary from paintings to pottery, from delft to dolls.

The galleries of many Cape Ann artists are tucked in among the shacks that once served the fishermen of a by-gone era. The special menu includes clams and hot boiled lobster.

Price: \$30 (min. 30 persons). Duration: 5 hours, evening, July 8.

#### HOTEL ACCOMMODATION

Accommodation is available at the Hyatt Regency Cambridge at the special rate of \$78.00 single and \$90.00 double. All rates are plus tax. Early reservation is necessary. Room availability cannot be guaranteed after June 15, 1982. Address: The Hyatt Regency Cambridge. 575 Memorial Drive, Cambridge, Mass. 02139, USA. Telephone: (617) 492-1254. Telex: 921409

#### SECRETARIAT

The Secretary, MIMI Cambridge, P.O. Box 25, Stn. G., Calgary, Alberta, Canada T3A 2G1. Telephone (403) 270-3616. Telex: 03-826670.