AN EPROM RESIDENT INTELLIGENT INTERFACE FOR ACCESS TO MULTIPLE BIBLIOGRAPHIC DATABASE SYSTEMS*

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ABSTRACT

It has been established that there is a need to provide end users with a facility to access multiple bibliographic database systems through a common command language, even though each system has developed its own command language. Most interface facilities have been developed on mini or large-scale computer systems and appear directed towards the simulation of the behavior of human search experts and/or towards computer-assisted instruction.

An intelligent interface is currently being developed which will provide the nonexpert with an inexpensive, basic facility to conduct such searches. A nearly transparent interface command language has been designed for video terminals. This interface may be EPROM resident in either an intelligent video terminal or a portable "black box" which can be used in conjunction with a dumb terminal.

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UN INTERFACE INTELLIGENT RESIDANT DE TYPE MMPE POUR L'INTERROGATION DE PLUSIEURS SYSTEMES D'INFORMATION BIBLIOGRAPHIQUE.

RESUME

On mentionne souvent le besoin de fournir à l'usager une façon d'interroger plusieurs systèmes d'information bibliographique en utilisant un seul langage de commandes, un méta-langage, même si chacun des systèmes opère avec son propre langage. La plupart des programmes d'interface ont été conçus pour des systèmes de mini ou de maxi ordinateurs et sont modelés sur une simulation du comportement de chercheurs experts et/ou de programmes d'auto-apprentissage.

Les auteurs présentent un nouvel interface intelligent en cours d'élaboration qui permettra à l'usager novice d'effectuer, à des coûts raisonnables, de telles recherches sur plusieurs systèmes. Un méta-langage d'interface presque transparent a ainsi été élaboré pour vidéo-terminaux. Cet interface peut être résidant de type MMPE(mémoire morte programmable électriquement) soit dans un vidéo-terminal intelligent, soit dans une "boîte noire" portative utilisable avec un terminal non-intelligent.

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INTRODUCTION

This is a report on research being conducted at the Technical University of Nova Scotia into the development of an EPROM resident intelligent interface for access to multiple bilbiographic database systems. An EPROM is an Erasable Programmable Read Only Memory which stores programs in such a way that an intelligent interface can be built directly into a terminal or into a "black box" situated between a dumb terminal and a modem. This interface is transparent to the user in that the user believes the interaction is directly with the target system. The interface is situated between the user and the target system as shown in Figure 1.

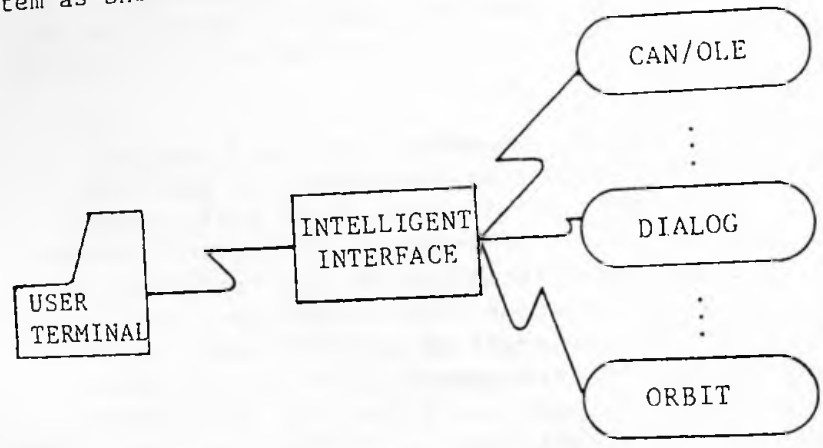

Figure 1. System Interface

As has been established (Goldstein, Ford, 1978; Standera, 1978; Stevenson, 1980) there appears to be a need to provide end users with a facility to access multiple database systems through a common command language even though each system has developed its own command language. Few users who have learned the command language of one system are likely to learn the command language of an alternate system offering similar or identical functions. It is also unlikely that commercial systems offering similar functions would change their command languages to a common language used by competitive systems. The most likely solution to this problem appears to be the definition of a common command language and an intelligent interface to translate commands from

this language into the corresponding commands of the target database system and the handling of ensuing responses from the target system.

Marcus and Reintjes (1981a, 1981b) have shown that intelligent interfaces can provide such a facility. They found, however, that expert human search intermediaries were still more effective than computerized experimental intermediary systems (Marcus, 1981). As such, the direction of their research appears to be toward the development of "smarter" interfaces which will more closely simulate the behavior of human experts.

The IIDA system (Meadow, Hewett, Aversa, 1982a, 1982b) has taken a computer-aided instruction approach to allow novice searchers to perform their own searches on the DIALOG system. IIDA both teaches and assists the user while searching. IIDA and CONIT3, the Marcus and Reintjes system, have been implemented on large-scale computer systems. IIDA makes extensive use of the CONIT3 software and CONIT3 requires about 200k bytes of storage on the M.I.T. MULTICS computer system.

Treu's "uniformizer" system (1982) presents a common command language and an intelligent interface accessing five different systems. This system was developed as a testbed facility for performing studies of user-computer interaction languages and is available on a minicomputer at the National Bureau of Standards.

There have also been efforts to incorporate interfaces into intelligent terminals. Horowitz, Eastlake, and Low (1980) have developed an intelligent terminal as part of the Chemical Substances Information Network (CSIN) which handles queries that use the results of previous queries to one or more component information systems by capturing the data output by one system, reformatting it, and transmitting it to another system. Preece and Williams (1980) have developed a prototype interface system contained in a central microcomputer. A separate microcomputer-based intelligent terminal accesses the target system through this central microcomputer.

It is the intention of this research project to develop an intelligent terminal which will provide the nonexpert end user with an inexpensive facility for conducting searches on various bibliographic data base systems through a common command language. The intent is not to emulate expert human search strategies but rather to allow a motivated researcher basic access to the databases available without requiring the researcher to be familiar with any of the particulars of the available database systems. The advantage of having this facility available as an inexpensive add-on to a user terminal should be self-evident.

THE USER POPULATION

The system has been designed with virtually the same user population in mind as that for Meadow's IIDA system which makes use

of the CONIT3 software. This user population is seen as one which has the need and inclination to utilize database searches at a basic level on their own. These users have the following characteristics:

1. they are end users of the technical literature;
2. they are aware of a specialized vocabulary within their subject areas;
3. they make use of manual retrieval tools such as citations, abstracts, and subject indices;
4. they would make infrequent use of such a system;
5. they would likely be looking for a few "good" citations or a good general bibliography;
6. they would prefer to conduct their own searches rather than work through a human intermediary.

DESIGN OBJECTIVES

The nature of the intended user population, as described above, forces the design objectives to be well defined. The objectives of the system are:

1. to provide a common command language to allow access to the various systems;
2. the human-machine interface must be simple to use and the system must provide unambiguous and simple prompts;
3. the system must be small enough and inexpensive enough to be stored in EPROMs in an intelligent terminal or "black box";
4. the system must dynamically assist the user in developing a satisfactory query.

COMMAND LANGUAGE

As the invisioned end user of this system is the nonexpert searcher, the command language should be simple and easy to learn for the casual user. Recognizing the inherent contradiction in trying to achieve this goal while providing the experienced user all conceivable facilities (Gebhardt and Stellmacher, 1978), the decision was made not to cater to the experienced user.

The functions available are similar to the main commands recommended in the Euronet Guideline (Negus, 1979), and implemented by Treu in the "uniformizer" system. Rather than the user specifying a command in the usual form of "VERB OBJECT" as in "FIND EURONET" where the verb FIND instructs the system to find all occurrences of the term EURONET, this system is menu driven. The functions available to the user through the menu mode are described in Figure 2. A system overview is presented in Figure 3.

SYSTEM SELECTION	to select CAN OLE, DIALOG, etc.
LOGON	to log onto chosen system
DATABASE SELECTION	to select database to be searched
SEARCH	to enter search mode
DISPLAY	to display items on-line at terminal
PRINT	to print items off-line
LOGOFF	to log off system

Figure 2. User Functions

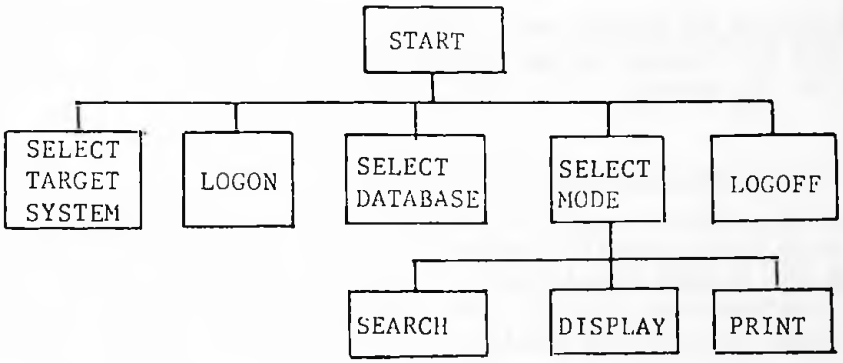

Figure 3. System Overview

SCREEN MAPPING

During the SEARCH, DISPLAY, and PRINT modes the screen is divided into three distinct areas as shown in Figure 4. All instructions and headers are displayed on the screen in half intensity. All user inputs and system responses are displayed in full intensity.

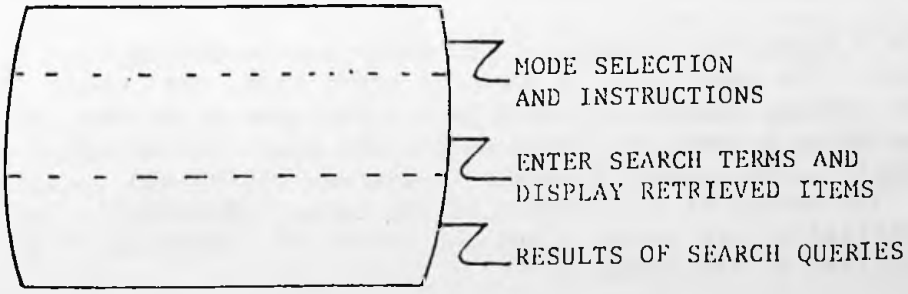

Figure 4. Screen Mapping

The top six lines of the screen are reserved for mode selection (SEARCH, DISPLAY, PRINT) and for displaying instructions for the use of the mode selected.

The middle nine lines of the screen are reserved for a variety of uses. Once a mode has been selected, the user inputs the search terms (words or set numbers) and logic (AND, OR, NOT) if in SEARCH mode, or the set and item numbers of the retrieved items for DISPLAY and PRINT modes. If the DISPLAY mode is chosen, the item requested is displayed in this area.

The bottom nine lines of the screen are reserved for displaying the results of the search query in the form "SET NUMBER, NUMBER OF HITS, QUERY". These results are formatted two across allowing a maximum of eighteen sets to be displayed at one time.

SEARCH MODE

Upon selection of SEARCH mode, the appropriate instructions are displayed and the cursor is automatically positioned in the middle section of the screen. The user then enters a search query in the form:

OPERAND [OPERATOR OPERAND]

where OPERAND is a term, possibly truncated, to be searched for or a set number from the bottom section of the screen and OPERATOR is one of *, +, or -, representing logical AND, OR, NOT, respectively. The operator and second operand are optional as indicated by the '[]'.

Upon translation to the appropriate format the query is transmitted to the target system. The response from that system is reformatted into "SET NUMBER, NUMBER OF HITS, QUERY" and displayed in the bottom section of the screen. The cursor is returned to the middle section of the screen to allow the user to extend or modify the search strategy. Set numbers from the display area can be used for the next iteration of the search procedure. Successive iteration of this procedure results in a history of the search strategy being displayed in the bottom section. This iterative procedure allows the user to dynamically modify or extend the search strategy based on intermediate results.

Figure 5 shows the contents of the video screen during a search session. The user input is shown in upper case, the cursor by ▮, and the system response in lower case. The user is in the process of entering a query logically ANDing the term "INTERFACE" with set number 3. Set number 3 is the result of "ONLINE AND RETRIEVAL". The number of occurrences of the term, "INTERFACE" will be identified as set number 4 and the result of "INTERFACE * 3" will be identified as set number 5.

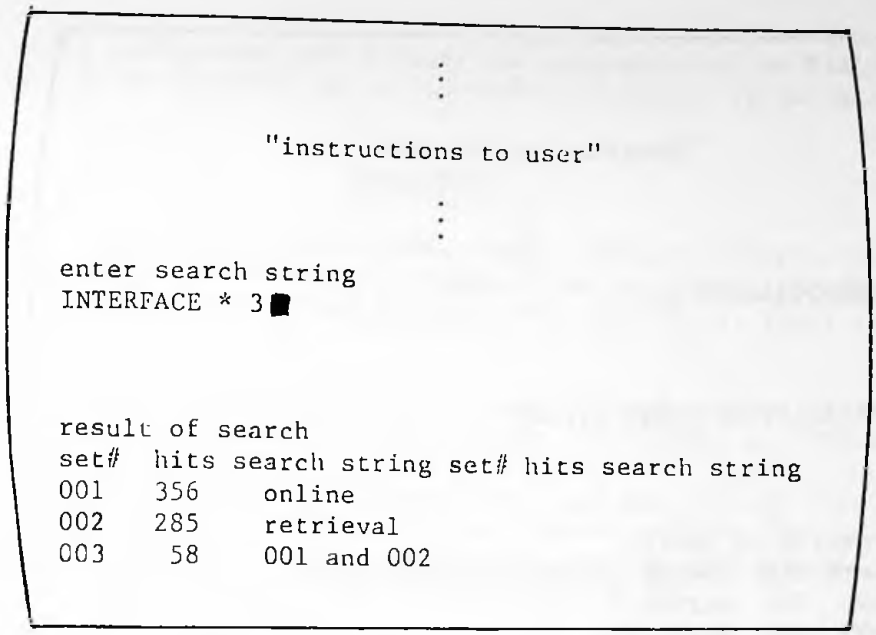

Figure 5. Example of Search Mode

DISPLAY MODE

Upon selection of DISPLAY mode, the appropriate instructions are displayed and the cursor is automatically positioned in the middle section. The user then enters the items to be displayed in the form:

SET NUMBER [, ITEM NUMBER | , ITEM NUMBER:ITEM NUMBER | space]

where a SET NUMBER is a set number as displayed in the bottom section and ITEM NUMBER is the number from the set, a range of item numbers from the set, or a space to indicate the default selection of the entire set.

The items are displayed in block mode in the middle section of the screen. The user advances to the next block of information by pressing the space bar. Any other input cancels the request.

Figure 6 shows the contents of the video screen during DISPLAY mode. A set number and item number have been selected as per the above format and one of the items has been display in the middle section of the screen.

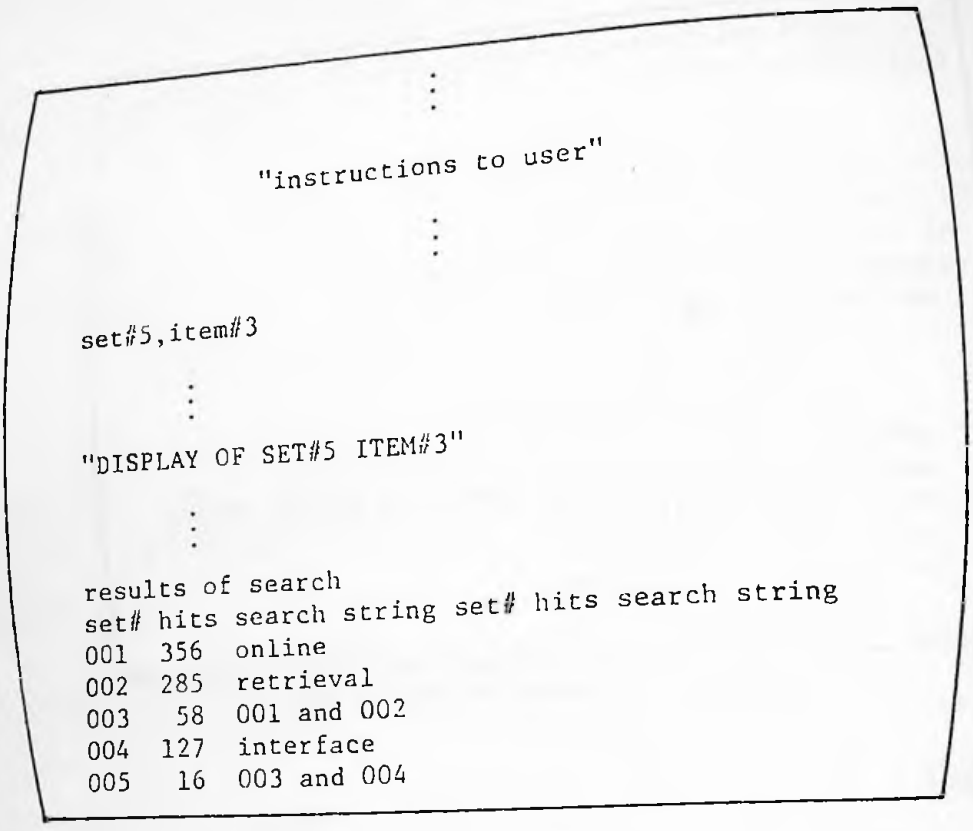

Figure 6. Example of Display Mode

PRINT MODE

This mode is identical to the DISPLAY mode except that requested items are printed offline on the target system instead of being displayed on the screen.

SYSTEM DEVELOPMENT

The system software is being developed on a Z-80-based microcomputer using the PLMX programming language. PLMX is a procedure-oriented language extensively used for systems development on microcomputers.

Testing of the system at various stages was done in "virtual" mode. Rather than communicating on-line with a target system or of simulating the appropriate responses with software, a second terminal was attached to the system and the programmer simulated the appropriate actions of the target system.

SYSTEM STATUS

A prototype microprocessor containing EPROMs has been developed and tested in "virtual" mode for a subset of the CAN/OLE commands. As of the writing of this report, the interface to the CAN/OLE system

is well under development and a start has been made on the DIALOG interface. It is intended to add the ORBIT interface in the near future.

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