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USL NASA/RECON PROJECT PRESENTATIONS

AT THE

1985 ACM COMPUTER SCIENCE CONFERENCE:

ABSTRACTS AND VISUALS

Frank Y. Chum
Suzy Gallagher
Martin Granier
Philip Hall
Dennis Moreau
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March 10, 1985
This Working Paper Series report comprises material presented by NASA/RECON research assistants at the 1985 ACM Computer Science Conference in New Orleans, Louisiana, March 12-14, 1985. Each entry includes both the abstract presented and the visuals used for the presentation.

The abstracts presented are:

1. "The Specification and Design of a Distributed Workstation" by Frank Y. Chum,
2. "An Innovative, Multidisciplinary Educational Program in Interactive Information Storage and Retrieval" by Suzy Gallagher,
3. "Critical Comparative Analysis of the Major Commercial IS&R Systems" by Martin Granier,
4. "Design Criteria for a PC-Based Common User Interface to Remote Information Systems" by Philip Hall,
5. "The Design of an Object-Oriented Graphics Interface" by Dennis Moreau, and
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| VI.  | KNOWLEDGE-BASED INFORMATION RETRIEVAL: TECHNIQUES AND APPLICATIONS | 62 |
I. THE SPECIFICATION AND DESIGN OF A DISTRIBUTED WORKSTATION

by

Frank Y. Chum
The Specifications and Design of a Distributed Workstation. FRANK CHU University of Southwestern Louisiana- This project includes the development of a general system for transparent sharing and access of resources in a distributed IS&R environment. The proposed PC-based distributed workstation (PCDWS) prototype will give IS&R users an integrated PC-based workstation environment for transparent access and sharing of resources available from both local and remote facilities. The PCDWS will provide a robust personal computer workstation environment with a comprehensive set of tools as functional components to serve the users, as well as intercommunication and uploading/downloading protocols between workstations and remote mainframes as well as between workstations, thus providing access to multiple local and/or remote DBMS and IS&R systems.

* This work was supported in part by the National Aeronautics and Space Administration under NASA Contract Number NASW-3846.

ACM Computing Reviews
Category Number(s)

B.4.3, C.2.4, H.4.3

Keywords

- Distributed System
  Communications
  Information Search and Retrieval
  Network Operations
DISTRIBUTED WORKSTATION SUPPORT

FOR

INFORMATION STORAGE & RETRIEVAL SYSTEMS
GENERAL GOALS AND OBJECTIVES

... Provide a mechanism for very wide distribution of the information storage and retrieval capabilities of NASA/RECON system.

... Provide the potential performance improvement of performing selected functions local to the users.

... Provide simulated information storage and retrieval system environments.

... Provide state-of-the-art technology available to the NASA/RECON system.
SPECIFIC R&D OBJECTIVES

"Provide a robust personal computer workstation environment with a comprehensive set of tools as functional components to serve as a scientist's / engineer's R&D workbench.

"Provide access to multiple DBMS and/or IS&R systems.

"Provide distributed/networked workstation communication and uploading/downloading protocols between workstations and remote mainframes as well as between workstations."
Phase I: Specifications

*** User Requirement Analysis

*** NASA/RECON Requirement Analysis

*** Distributed Workstation Functional Specifications

*** Evaluation of Candidate Workstation Systems

*** Selection of Candidate Systems

*** Model System and Network Architecture
RESEARCH & DEVELOPMENT METHODOLOGY (Cont'd)

Phase II: Design and Implementation

*** Implementation Study and Design Specifications

*** System Implementation

*** Testing and Debugging

*** Prototyping of Finished System
Phases III: Deployment

*** Development Deployment and Support Strategies

*** Operational Maintenance and Enhancement

*** Performance Measurement and Evaluation
II. AN INNOVATIVE, MULTIDISCIPLINARY EDUCATIONAL PROGRAM IN INTERACTIVE INFORMATION STORAGE AND RETRIEVAL

by

Suzy Gallagher
An Innovative, Multidisciplinary Educational Program in Interactive Information Storage and Retrieval SUZY GALLAGHER University of Southwestern Louisiana-A description of the development of a set of transportable, college-level courses in the use of interactive, online IS&R systems, in particular the NASA/RECON system, is presented. The purpose of these courses is to educate science and engineering students in the effective use of automated scientific and technical IS&R systems. The presentation includes an overview of project objectives, management phases, and accomplishments to date. The methodology used for the course development is described and future plans, both long-term and short-term, are discussed.

* This work was supported in part by the National Aeronautics and Space Administration under NASA Contract Number NASW-3846.

ACM Computing Reviews
Category number(s)
(January 1984 revision)

H.3.0, K.3.2

List major key words
in order of importance

Education
Information systems education
Online information services
An Innovative, Multidisciplinary Educational Program in Interactive Information Storage and Retrieval

An Abstract of Thesis Research
Presented to
The Association for Computing Machinery
Thirteenth Annual Computer Science Conference

by
Suzy Gallagher
University of Southwestern Louisiana

March 12, 1985
PROJECT OBJECTIVES

Set of Courses

Hands-on Usage

Science and Engineering Students

Transportable Courses
MANAGEMENT PHASES OF NASA CONTRACT

A. Needs Analysis
B. Course Development
C. Pilot Course Administration
D. Pilot Evaluation
E. Development of Distribution Plan
F. Implementation of Distribution Plan
G. Conduct of Regional Seminars
H. Conduct of On-Site Seminars
I. Coordination of Request Processing and Information Dissemination
J. Course State-of-the-Art Enhancements
K. Institutional Surveys and Evaluations
L. Graduated Student Surveys and Evaluations
M. Periodic Statistical Summary Reporting
OVERALL COURSE DEVELOPMENT DIAGRAM

Needs Analysis Survey --> Deliverables Development --> In-House Evaluation --> Final Product
COURSE DELIVERABLES DEVELOPMENT DIAGRAM

Outline

General References

System References

Visuals

Online Searches

Lesson Plans
Handouts
Instructor Notes
Usage Assignments and Keys

Homework Assignments and Keys
Examinations and Keys

- 18 -
MAJOR CATEGORIES OF ACCOMPLISHMENTS

Project Control

Needs Analysis

Project Working Paper Series

Course Development Working Paper Series

PC R&D Working Paper Series

Other Research Support
PC R&D Project

- Establish PC R&D Environment
- Integrated PC Workstation
- PC-Based IS&R Education Tools

OBJECTIVES:
- Continual Evaluation
- Develop Methods & Specifications
- Identify & Evaluate Projects
- Prototype PC Workstation

Local Environment Interface
Remote Interface
Distributed Interface

NASA/RECON Emulator
IS&R Emulator Generator
Interactive Presentation Development System

Relationship Between PC R&D Goals
FUTURE OF THE NASA/RECON EDUCATION PROJECT

Short Term

Define Additional Course Configurations
Pilot Administration
Pilot Evaluation
Distribution Plan Development
Additional Systems
Additional Disciplines
SYSTEM INCORPORATION DIAGRAM

COURSE
  - Hooks

HOMEWORK
  - Hooks

NASA/RECON

EXAMINATIONS
  - Hooks

USAGE ASSIGNMENT
  - Hooks

HANDOUTS
  - Hooks

PRESENT

OTHER SYSTEMS

FUTURE
DEVELOPMENT PLAN FOR THE SET OF 4 COURSES

- 1-2 Day Intensive Workshop
- 6 Week Mini Course
- 12 Week Full Quarter Course
- 18 Week Full Semester Course
FUTURE OF THE NASA/RECON EDUCATION PROJECT

Long Term

Distribution

Evaluation

Extensions

Enhancements

Non-Educational Institutions

Request and Information Processing

Result Reporting
CONCLUSIONS

End User Education

Co-ordinated Materials

Complete

Varied

Extensions

IS&R Systems

Disciplines

Enhancements

Improvements

Updates

Transportability
III. CRITICAL COMPARATIVE ANALYSIS OF THE MAJOR COMMERCIAL IS&R SYSTEMS

by

Martin Granier
Critical Comparative Analysis of the Major Commercial IS&R Systems. MARTIN GRANIER
University of Southwestern Louisiana - The number of online search services commercially
available to the public today has, in many cases, complicated the search process for the
casual user. Faced with an increasing number of systems, each one necessitating the mastery
of a different retrieval language and a particular set of protocols, the user is left
confused and often unable to satisfactorily complete his search. This study compares the
syntax, semantics and functions of the different languages used by some of the
commercial IS&R systems available in the United States today. It also leads to a proposal for
a common command language which would cover the functions most needed during the retrieval
process.

* This work was supported in part by the National Aeronautics and Space Administration
under NASA Contract Number NASW-3846.

ACM Computing Reviews
Category number(s)
(January 1984 revision)
H.2.3, H.3.3, H.3.5, K.6.3

List major key words
in order of importance

Information Search and Retrieval
On-Line Information Services
Query languages
Software development
CRITICAL COMPARATIVE ANALYSIS

OF

THE MAJOR COMMERCIAL IS&R SYSTEMS

by

MARTIN GRANIER

Center for Advanced Computer Studies
- University of Southwestern Louisiana
  P.O. Box 44330
  Lafayette, Louisiana 70504
PROBLEMS FACING

USERS OF INFORMATION SERVICES

*** NUMEROUS AND VARIOUS SERVICES
*** SELECTING A SYSTEM
*** INTERROGATION LANGUAGES

AND SEARCH STRATEGIES VARY

*** DIFFICULT TO REMEMBER

MORE THAN A FEW COMMANDS

*** SAME DATABASES OFFERED

ON DIFFERENT SYSTEMS

*** SEARCH METHODS ON DIFFERENT SYSTEMS

*** LOGIN ACCESS

*** SEARCH QUERIES

*** DIFFERENT OUTPUT FORMAT
PROBLEMS FACING

USERS OF INFORMATION SERVICES (cont'd)

 *** STORING OUTPUT

 *** COMPARISON OF SEARCHES

 *** SUPPORT

 *** COMMUNICATIONS PROCEDURES

 *** CASUAL USERS

  *** TIME CONSUMING

  *** EXPENSIVE

  *** FEAR OF USAGE
POSSIBLE SOLUTIONS

*** SEARCH SPECIALIST

*** USER INTERFACE

*** FRIENDLY GATEWAY

*** EDUCATING USERS

*** MULTIPLE LEVELS OF ACCESS

*** NATURAL LANGUAGE SEARCH

*** STANDARDIZATION: COMMON COMMAND LANGUAGE
THE ISSUES

... COMPATIBILITY

... LANGUAGE

... SAME INFORMATION ON DIFFERENT DATABASES
THE GOALS

*** HELP THE CASUAL USER

*** GIVE A BETTER AND MORE COMPLETE
COVERAGE OF SEARCH

*** COMPARISON OF COVERAGE, TIME AND PERFORMANCE

*** ACCESS MANY DATABASES

*** FACILITATE THE FORMATTING OF OUTPUTS
OUTLINE OF STUDY

*** COLLECTION OF INFORMATION

*** SELECTION OF SYSTEMS

*** ANALYSIS OF AVAILABLE DATA

*** PROPOSAL AND CRITICISM OF PROPOSED SET

*** FIRST DRAFT OF COMMON COMMAND LANGUAGE

*** APPLICABILITY TO EXISTING IS&R SYSTEMS

*** POSSIBLE METHODS OF IMPLEMENTATION

*** ANALYSIS OF RESULTS
COLLECTION OF INFORMATION

*** SELECT LITERATURE

*** SYSTEM USAGE

*** EXCHANGE WITH USERS

*** EXCHANGE WITH PROFESSIONAL SEARCHERS

*** EXCHANGE WITH SYSTEM DESIGNERS

*** USER MANUALS AND SYSTEM DOCUMENTATION
SELECTION OF SYSTEMS

"MAJOR" ONLINE VENDORS

AVAILABLE TO A WIDE USER COMMUNITY

COMMERCIAL NETWORKS

SEARCH LANGUAGE IN ENGLISH

AVAILABLE IN THE US

OFFERING A MINIMUM OF

COMMERCIAL DATA BASES

AVAILABLE PUBLICATIONS

SELECTION OF COMMANDS
SYSTEM LIST

*** BRS

*** CAS-ONLINE

*** DIALOG

*** ISI

*** MEDLARS

*** ORBIT

*** PERGamon-INFOLINE

*** QUESTEL

*** VU-TEXT
PROPOSAL AND CRITICISM OF PROPOSED SET

*** ADVANTAGES OF CCL

*** DISADVANTAGES OF STANDARDS

*** DRAWBACKS OF CCL
ADVANTAGES OF CCL

*** DEGREE OF STANDARDIZATION

BETWEEN SYSTEMS

*** WOULD BENEFIT:

USERS

PRODUCERS

PROCESSORS

*** TECHNOLOGICAL ADVANCES
DISADVANTAGES OF STANDARDS

*** COST OF COMPLYING

*** RIGIDITY

*** SPECIAL CASES

*** INVESTMENT

*** DOUBLE SET OF COMMANDS

MUST BE ACCEPTABLE

*** NECESSARY COMPROMISE

*** CONFLICTS MAY EXIST

*** PREVIOUS ATTEMPTS (CCL, ISO)
FIRST DRAFT OF

COMMON COMMAND LANGUAGE

... COMMON DEFINITION OF

RETRIEVAL SYSTEM FUNCTIONS
- COMMANDS TO INCLUDE (Cont'd)

... DATABASE
... DEFAULT <arguments>
... DISPLAY
... ERROR <message>
... FIELD <labels>
... LIMIT
... LOGIN
... LOGOUT
... NEWS
... REVIEW
... SHOW
DIFFERENCE BETWEEN LANGUAGES

*** COMMAND NAMES

*** COMMAND STRUCTURES

***** SEARCH MODE

***** COMMAND MODE

*** COMMAND FEATURES

*** COMMAND FORMATS
### COMPARATIVE STUDY

**COMMAND LANGUAGES FOR VARIOUS IS & R**

<table>
<thead>
<tr>
<th>ERS</th>
<th>DIALOG</th>
<th>ORBIT</th>
<th>QUESTEL</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>:</em></td>
<td>?</td>
<td>USER:</td>
<td>display</td>
</tr>
<tr>
<td>root</td>
<td>expand</td>
<td>neighbor</td>
<td></td>
</tr>
<tr>
<td>and</td>
<td>and</td>
<td>and</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td>or</td>
<td>or</td>
<td></td>
</tr>
<tr>
<td>not</td>
<td>not</td>
<td>not</td>
<td></td>
</tr>
<tr>
<td>adj</td>
<td>(w)</td>
<td>(w)</td>
<td>adj</td>
</tr>
<tr>
<td>with</td>
<td>(s)</td>
<td>(s) adj</td>
<td>sens</td>
</tr>
<tr>
<td>same</td>
<td>(f)</td>
<td>(f)</td>
<td>nosens</td>
</tr>
<tr>
<td>and</td>
<td>(c)</td>
<td>(c) (r)</td>
<td>dst</td>
</tr>
<tr>
<td>print</td>
<td>printoff</td>
<td>print</td>
<td>type</td>
</tr>
<tr>
<td></td>
<td>type</td>
<td>prt offline</td>
<td>print pr</td>
</tr>
<tr>
<td></td>
<td>dialorder</td>
<td>order (supplier)</td>
<td>order</td>
</tr>
<tr>
<td>off</td>
<td>logoff</td>
<td>stop</td>
<td>logoff hold</td>
</tr>
<tr>
<td></td>
<td>logoff hold</td>
<td>stop yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIALOG</td>
<td>ORBIT</td>
<td>OTHERS</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>[logout/login]</td>
<td>[logout/login]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* FILE file no.</td>
<td>FILE file name</td>
<td>(*) number</td>
<td></td>
</tr>
<tr>
<td>EXPAND term</td>
<td>NEIGHBOR term</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SELECT topic</td>
<td>FIND topic</td>
<td>SEARCH</td>
<td></td>
</tr>
<tr>
<td>SELECT AU = name</td>
<td>FIND name (AU)</td>
<td>SEARCH</td>
<td></td>
</tr>
<tr>
<td>SELECT a (C) b</td>
<td>FIND a AND b</td>
<td>SEARCH</td>
<td></td>
</tr>
<tr>
<td>COMBINE m * n</td>
<td>m AND n</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMBINE m + n</td>
<td>m OR n</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE x/2</td>
<td>PRINT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE x/6</td>
<td>PRINT TI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRINT x/2</td>
<td>OUTPUT OFFLINE</td>
<td>MAIL, PRINTOFF</td>
<td></td>
</tr>
<tr>
<td>TYPE n/2</td>
<td>Sn/OUTPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>?NEWS</td>
<td>NEWS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOGOFF</td>
<td>STOP</td>
<td>DONE, QUIT</td>
<td></td>
</tr>
<tr>
<td>(all done?)</td>
<td>LOGOUT, FINISH</td>
<td>BYE, BYE-BYE</td>
<td></td>
</tr>
</tbody>
</table>
FUTURE RESEARCH

*** APPLICABILITY TO EXISTING IS&R SYSTEMS

*** POSSIBLE METHODS OF IMPLEMENTATION

*** ANALYSIS OF RESULTS
CONCLUSION

WITHOUT STANDARDS

*** NOT IN USERS INTEREST
*** ANARCHY
*** INHIBIT SEARCH
*** LOSS OF CUSTOMERS
*** LOSS OF REVENUES

WITH STANDARDS

*** ALL QUERIES ASKED IN ONE WAY
*** ABILITY TO SWITCH BETWEEN SYSTEMS
*** PRESERVE PARTICULARITIES OF SYSTEMS
*** NO CHANGE TO ORIGINAL DESIGN
*** INCREASES ACCESS TO ONLINE SYSTEMS
*** INCREASES USAGE OF ONLINE SYSTEMS
IV. DESIGN CRITERIA FOR A PC-BASED COMMON USER INTERFACE TO REMOTE INFORMATION SYSTEMS

by

Philip Hall
Design Criteria for a PC-Based Common User Interface to Remote Information Systems

PHILIP HALL University of Southwestern Louisiana

The problems associated with retrieval by casual users of information stored in remote IS&R systems and the possible utilization of personal computers to solve these problems are discussed. A standardized system which will allow the user to access information stored in many distinct systems through a single common interface is described. The intent of this system is to spare the user the necessity of learning multiple command languages in order to access multiple systems and also retain the full retrieval capabilities of each system. Several levels of interaction are provided to facilitate new user learning phase activity and allow the intermediate and advanced users to interact with the system with the minimum necessary prompting. The system is designed to maximize utilization of local processing and display capabilities and to provide built-in evaluation tools.

* This work was supported in part by the National Aeronautics and Space Administration under NASA Contract Number NASW-3846.

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Major Key Words:

User Interface Design
User/System Interaction
Information System Interfaces
Personal Computers
Online Information Services
USL NASA
Personal Computer
Research
and
Development
PC-BASED COMMON INTERFACE TO MULTIPLE REMOTE IS&R SYSTEMS
DEFINING THE CASUAL USER

*** 70% of User Population

*** Characteristics

*** No Desire to Memorize Command Languages
*** Infrequent Access to System
*** Limited Knowledge of Programming
*** Limited Knowledge of Command Languages
*** Extensive Knowledge of Subject Field
*** IS&R Access not REQUIRED By Job
*** Job Enhancement Thru IS&R Access
TRADITIONAL
- INFORMATION SPECIALIST USAGE

\[
\begin{align*}
\text{INFORMATION} & \quad \downarrow \\
\text{SYSTEM} & \quad \downarrow \\
\text{INTERFACE} & \quad \downarrow \\
\text{INFORMATION SPECIALIST} & \quad \downarrow \\
\text{END USER} & \quad \downarrow 
\end{align*}
\]
END-USER
MULTIPLE SYSTEM USAGE

INFORMATION

SYSTEM

INTERFACE

SYSTEM

INTERFACE

SYSTEM

INTERFACE

END USER
DESIGN GOALS

*** Ease of Access to Different Systems
*** Handle Communications
*** Facilitate Addition of New Systems
*** Incorporate Changes to Existing Systems

*** Improve User/System Interaction
*** One Interface to All Systems
*** System Documentation
*** Multilevel Design
*** Facilitate Downloading
FUTURE ENHANCEMENTS

*** Expert System / AI Applications

*** Enhance User Queries

*** "Advice" to Users

*** "Find" System With Information
V. THE DESIGN OF AN OBJECT-ORIENTED GRAPHICS INTERFACE

by

Dennis Moreau
The Design of an Object Oriented Graphics Interface. DENNIS MOREAU University of Southwestern Louisiana. A description of an advanced graphics interface design that provides the applications developer with a very high level graphics environment is presented. The object oriented design is shown to be appropriate to achieving device and implementation independence. This approach is also shown to provide a flexible means of managing non-graphic information associated with graphic objects. Implementation, using standard graphics primitives, is proposed.

* This work was supported in part by the National Aeronautics and Space Administration under NASA Contract Number NASW-3846.

ACM Computing Reviews
Category Number(s)
(January 1984 revision)

H.1.2, I.3.2

List major keywords
in order of importance

Graphics Interface
Object oriented environment
An Object-oriented Graphics Interface

Objectives:

To provide an easy to use interface for graphics applications development.

To provide conceptually consistent structure for partitioning graphics functionality.

To provide an extensible environment for archiving graphics components and tailoring available functions.
Interface Evaluation

Test Applications

Interactive Presentation Development System

3-D Surface Construction and Display System

Dataflow Programming Workstation

Evaluation Parameters

Development Time

Application Port Complexity

Performance Degradation

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VI. KNOWLEDGE-BASED INFORMATION RETRIEVAL:

TECHNIQUES AND APPLICATIONS

by

Spiros Triantafyllopoulos
A collection of knowledge-based tools and techniques in support of information retrieval is presented. Applications such as natural language query systems, data integrity and consistency control, and intelligent interfaces to remote systems and DBMS front-ends, are discussed. Knowledge-based tools and techniques in support of such applications, including frame- and rule-based knowledge representation, knowledge acquisition and utilization, and intelligent dictionaries are presented. The presentation includes future research issues and extensions to existing applications and methods.

* This work was partially supported by the National Aeronautics and Space Administration, under NASA Contract Number NASW-3846.
Knowledge-Based Information Retrieval:

Techniques and Applications

by

Spiros Triantafyllopoulos

Center for Advanced Computer Studies
University of Southwestern Louisiana
Lafayette, LA. 70504

- 64 -
THE RETRIEVAL PROCESS

*** Task: Data or Information Retrieval

*** Available Solutions:

*** Application Programs

*** "Canned" Command Files

*** Menu Systems

*** Programming Languages

*** Query Languages

*** Oriented towards the Frequent User

*** Casual User has to Invest:

*** Time

*** Effort

*** Typically, too many Rules, Languages and Terms
THE RETRIEVAL PROCESS (Cont'd)

*** Specialized Software System Knowledge Required from the User's part

*** The Software System itself does not have any Knowledge of the Human's Process of Thought

*** The Result: Knowledge Gap between User and System

*** The Solution: Make a Part of the User's Knowledge available to the System
KNOWLEDGE ISSUES

... Knowledge Representation

... The encoding of domain-specific knowledge in a machine-readable and usable format

... Knowledge Utilization

... The use of knowledge by the DBMS to assist the user in the retrieval process

... Knowledge Acquisition

... The acquisition of knowledge at either

--- Program development time

--- Program initialization time

--- Program execution time
Frame-Based
All Knowledge about an entity in one "slot"

Rule-Based
Allowable Constructs specified by rules

Knowledge Storage and Retrieval

Typically, a Separate KBMS (Knowledge Base Management System) is used

This approach uses the Host DBMS/FMS for Knowledge Storage and Retrieval

Knowledge transformations needed

Frame-Based knowledge made to fit into table form (relationships)
--- Normalization
--- Redundancy Elimination
--- Storage Efficiency

Rule-Based knowledge also transformed to "fit" in table form
An Example of Knowledge Representation

NAME: salary
TYPE: noun
DATATYPE: numeric, real
RANGE: 0.00 to 99,999.99
PATTERN: \{ $ \} \{0-9\} \{ . \{0-9\}\} \}
USED BY: raise, pay, add, subtract
IS-A: object
APPLICABLE-TO: employee
OPERATORS: ge, le, gt, lt, eq, ne
UNIT: $, dollar, dollars
SYNONYMS: payment, paycheck, pay

Can be represented in relations as follows
Proposed Knowledge Representation

**noun frame**

| name | type | datatype | max | min | pattern | unit |

**synonyms representation**

| term | stands for |

**verbs representation**

| verb | subject | object |

**adjective representation**

| adjective | noun | implies |

**dictionary representation**

| word | word type |

**multiword representation**

| term | pattern | id | rank |
In addition, the following knowledge is needed to process the user requests

Allowable Syntactical Constructs

--- Since it is fairly constant, syntax is "hardcoded" in pattern form

--- Verification of input pattern via matching with allowable patterns

Allowable Lexical Terms

--- Also stable, "hardcoded" in the program

--- Rules that transform different grammar forms in the ones known by the system (i.e., different tenses, singular/plural forms, etc.)
**KNOWLEDGE UTILIZATION**

*** Knowledge is abstracted as

- nouns
- verbs
- adjectives
- sequences of words (idioms, etc.)
- noicewords
- overall organization (DB schema)

*** With such abstraction, it is relatively simple to design and implement the knowledge processor for the restricted natural language

*** Abstraction hides all details of storage/retrieval

*** Knowledge processor asks for knowledge from the DBMS-implemented KBMS
Natural Language Processing

Utilizing Domain Vocabulary knowledge and "natural" language constructs

--- Lexical Analysis
--- NL Query Parsing
--- Syntactic Verification
--- Semantic Verification
--- Formal Query Generation

Formal Query Evaluation

--- Handling of Null Results
--- Query Simplification
--- Query Optimization

Other Usage

--- Format Selection
--- Full Report Generation
KNOWLEDGE UTILIZATION (Cont'd)

*** Knowledge Abstraction Facilitates

General System Design

*** Modularity

*** Granularity

*** Portability

*** Variety of Applications

*** Knowledge Utilization Modules

*** Require no special languages
  i.e., Prolog, Lisp, etc.

*** Require no special Environment

*** Require no special knowledge in
  the implementation phase

*** Use simple algorithms
LEXICAL ANALYSIS

PARSING PROCESSOR

SYNTAX VERIFIER

SEMANTIC VERIFIER

FORMAL QUERY GENERATION

FORMAL QUERY EVALUATION

QUERY POST PROCESSING

Intelligent Dictionary Grammar Knowledge
Intelligent Dictionary Syntax Knowledge
Syntax Knowledge Schema Knowledge
Semantic Knowledge Schema Knowledge
Schema Knowledge
Schema Knowledge
Schema Knowledge
Formal Query Syntax Knowledge
Formal Query Semantic Knowledge
Formal Query Syntax Knowledge
Formal Query Semantic Knowledge
DBMS Specific Knowledge
Output Device Knowledge
User Profile of Formats
KNOWLEDGE ACQUISITION

*** Knowledge is acquired at

*** System Design Time
--- Grammar Rules
--- Grammar Transformation Rules
--- Syntactic Patterns
--- Syntactic Rules

*** System Initialization Time
--- Schema-based Knowledge
--- Domain-specific Knowledge
--- Dictionary Initialization
--- Basic Knowledge needed for the system to become operational
--- Common Knowledge (applicable to a group of domains)
--- Transformation of Schema
KNOWLEDGE ACQUISITION (Cont'd)

... At System Run Time

--- System can "learn" new entries

--- If a term is unknown, after all transformations, system asks

--- If application domain is expanded

system can learn the new terms

... At System Maintenance Time

--- Updates to present Knowledge

--- Corrections to present Knowledge

--- New definitions/terms
Access problems have to be solved

Who has access to add knowledge

Who has access to modify knowledge

Who is responsible for initializing the KBS

How the system can be tailored for use at a Production environment

How the system can be maintained at such an environment
CONCLUSIONS

*** Advantages

--- Increased applicability

--- Knowledge about the application is not hardcoded in the system, but can be expanded/tailored

--- Increased system flexibility

--- No specific KBVPS Needed

--- No specific DEVS Needed (Minimal code changes in the formal query generation module)

--- No specific environment

--- Modularization and abstraction
CONCLUSIONS (Cont'd)

*** Simpler system
--- Design time is reduced
--- Implementation time is reduced
--- No specific implementation
Knowledge needed

*** Disadvantages

*** Storage efficiency
More required due to normalization/
transformations in relational form

*** Execution efficiency
Slower due to database accesses for
knowledge retrieval

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This Working Paper Series entry represents the abstracts and visuals associated with presentations delivered by six USL NASA/RECON research team members at the above named conference. The presentations highlight various aspects of NASA contract activities pursued by the participants as they relate to individual research projects. The titles of the six presentations are as follows:

2. "An Innovative, Multidisciplinary Educational Program in Interactive Information Storage and Retrieval."
5. "The Design of an Object-Oriented Graphics Interface, and"

This report represents one of the 72 attachment reports to the University of Southwestern Louisiana's Final Report on NASA Grant NGT-19-010-900. Accordingly, appropriate care should be taken in using this report out of the context of the full Final Report.