Title: The Design and Implementation of an Information System for IEEE Transactions on Engineering Management

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Abstract: This term project is about the analysis of a database project done for the IEEE Transactions on Engineering Management. This paper is to draw a large picture of the information system used in the IEEE Transactions on Engineering Management paper tracking system. The paper first introduce basic information about the database and then enlarge its focus and define the information system and shows how the database is fitted into it.

The Design and Implementation of an Information System for IEEE Transactions on Engineering Management

A Uslu

EMP-P9773

EMGT 606: Database Design

The Design and Implementation of an Information System for IEEE Transactions on Engineering Management

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Introduction

This term project is about the analysis of a database project done for The IEEE Transactions on Engineering Management. While database were being designed and programmed, the attention was on programming rather than the design of the system. At that time If we were asked 'what is an information system', we would answer as 'the database' itself. While this answer is true up to a certain level, it is obvious that an information system encompass much more than a database.

The aim of this project is to draw a larger picture of the information system used in The IEEE Transactions on Engineering Management paper tracking system. We will start by defining the parties involved in our information system in the light of generic information system model. From that point we will show the role of the database in the 'complete' information system.

We will first introduce basic information about the database, how the project has started and then we will enlarge our focus and define our information system and show how the database is fitted into it.

Problem Definition

Problem definition statement

Our objective is to design a database system that will replace current database and eliminate constraints created by old database which tracks the manuscripts that are submitted to IEEE Transactions on Engineering Management, at every stage of the review process.

Feasibility

First question about developing an information system for an organization is whether it is feasible to develop it in-house or order an off the shelve program and try adapt it to existing procedures.

In our case the answer to that question was simple since the procedure for paper reviews changes from one journal to another. Therefore it is difficult to find a software package that will fit our requirements.

Second part of the question refers to the development of the software. The answer again is obvious: a graduate assistant is always cheaper (inexpensive) than a outside developer.

Now the question becomes whether to start all over again to the design and programming of the database or try to fix and improve the old database. During our first meeting with Dr. Kocaoğlu, I objected to the improvement of the old database. If we try to improve the old database I would have to spend time much of my time to understand the old database, and then another almost equal time for the fixes

Strategic Planning

We will analyze strategic planning in four major phases as suggested by Mark L. Gillenson and Robert Goldberg in their book "Strategic Planning, Systems Analysis and Database Design" on page 11.

Organization strategic planning (OSP)

OSP is to plan for an organization's information systems resources. In our case Engineering Management is committed to make necessary investments for the DOS/Windows compatible machines since all of our software are DOS or Windows based. Therefore as the next step in organization strategic planning is to upgrade all of our software to Windows.

This upgrade also includes our database which was written for DOS. Therefore the new platform for the new database will be Windows.

Information systems strategic planning (ISSP)

ISSP is to plan to be able to keep up with the growth of the organization. This concept has many implications on the structural design of the database but we prefer to discuss here a higher level design issue that is the selection of language and database software. To be able to allow the flexibility and upgradeability we chose FoxPro for Windows which is SQL based. FoxPro is not only a low level database design software but also owned by Microsoft which results in a longer term investment.

Detailed systems analysis

This part will be handled in the next section 'Analysis of Activities.'

Database design

This part will be handled in the section of 'Design Activities.'

Analysis of Activities

Existing system

As shown in figure 1 the general structure of the IEEE Transactions on Engineering Management (IEEE-TEM) is formed of an editor in chief (EC), seven editors of each department (which are formed by editor in chief and an editorial assistant. Papers are submitted through EC and first evaluated by him then EC decides whether he himself will supervise the review process or pass the paper to one of the editors.

If he chooses to conduct the process himself then next step is to select referees and follow on with review of the paper. If other case happens then EC just sends the paper to the according editor and does not hear from him until the end of the review process.

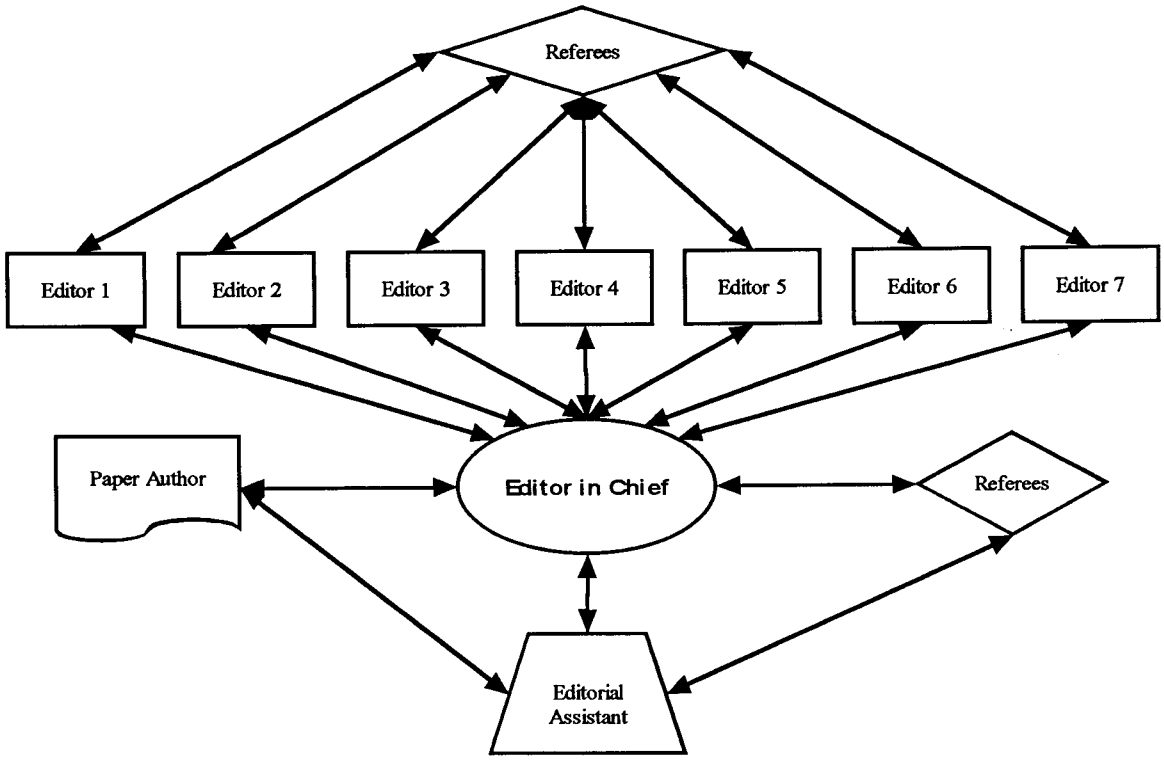


Figure 1

From authors' perspective, if EC is the editor then they need to keep in touch with him during the review process, if on the other hand the paper is sent to one of the editors then they need to contact with that specific editor.

Even though from outside it seems like EC is the center of all data and information exchange between parties, actually the editorial assistant handles most of the required tasks. The only tools she uses are her file cabinet and a database designed five years ago.

Problems with the existing system

Existing system is a result of the experience of the editorial assistant. She has created her own filing system and used database as a complimentary to her filing system. She is able to answer most of the questions regarding the review process as long as she has been given enough time.

For the last year and a half she had to quit using database because of its limitations. More clearly she was not able to add new referees to the system because the way the database is designed. Another problem the database was not designed from her perspective, rather it is a result of EC's perspective. Next step will be to design the information system model according to our general concept.

Information System Model

Figure 2 represents the generic model for the information systems. We will explain our information system in terms of generic model to better understand, communicate and predict the outcomes of our project.

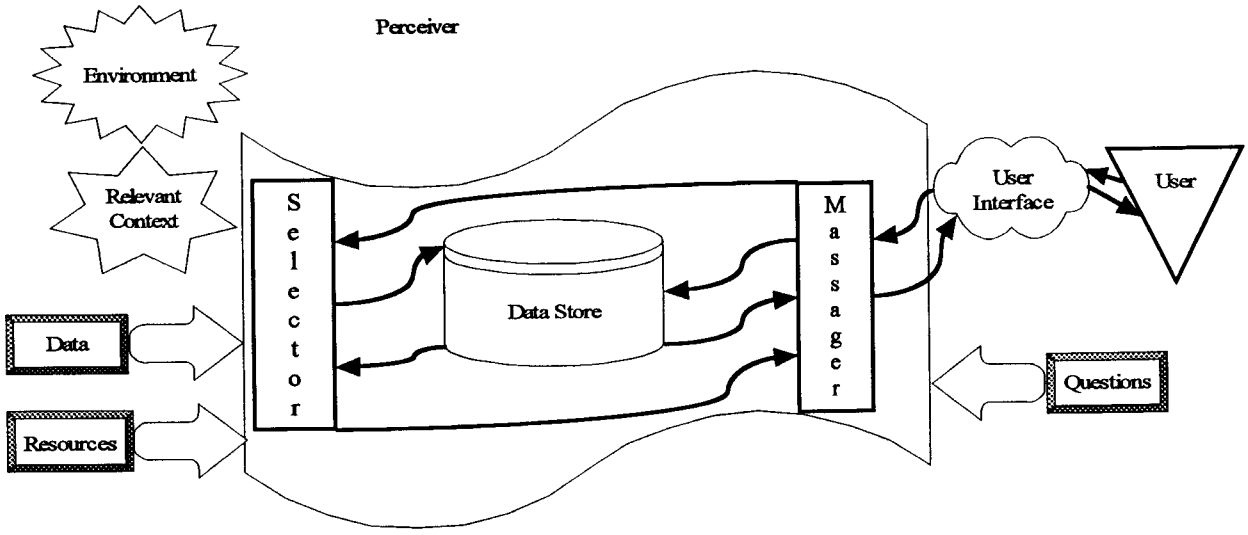


Figure 2

Here are the components of the information system and their respective in out IEEE-TEM:

Users

Following users have been identified as the people who will be involved with the information system:

- 7 Department Editor
- 1 Editor in Chief
- 1 Editorial assistant

Inputs

- Data from the papers that are submitted: Author names, title of the paper.
- Scores that are sent by referees
- Editor suggestions for papers: Whether it is acceptable or not.
- Personal Data: Names, addresses, phone numbers and which of the 50 categories defined by Dr. K. do they belong.

- Departmental Data: Which subjects belong to which department and who is the editor of that department.
- Survey Results: Identification of referee interest areas for review processes.

Questions and Outputs

- Paper status: Editor in chief will be able to see at which stage a paper is during the review process.
- Referee status: How many papers they are being reviewed and what are their preferences for paper reviews.
- Department status: How many papers each department is being reviewed by each department.
- Searches on categories: List of people that belong to a category or to a group of category.
- Searches on referees: List of referees that prefer to review papers on the topic selected.

Data Stores

- Electronic database on a PC
- Paper files

Selectors

- Graphical user interface of database
- Editor in chief
- Department editors
- Editorial assistant

Massager

- Program modules that will make the necessary searches and handles the data that are entered into the database.

- Editorial assistant
- Editor in Chief

If we had used this information system model at the beginning of the project to analyze our problem, we would have been in better situation in terms of understanding the processes used by the people involved with the review process.

It is clear that the old database has been designed and programmed from the perspective of EC which is quite complex and difficult to understand for an outsider. On the other hand if you look from EA's perspectives thinks are much simpler and easier to understand.

To force EA to use a system which is designed from another perspective is one of the main problems that we had overcome. Our new database system might have ended as the old system if we did not talk to EA. Fortunately, we had the chance to talk to her and get not only a simpler version of the procedures but also the key features that are critical in supporting her daily job.

Functional requirements of the new system

Since we have been brought in to the project as database designer we did not have chance to redesign or improve the current process. We have only been asked to program a database that will work in coordination whit the way they handle paper review process. Therefore we did not have any say that might improve both the review process and database efficiency. In result when we talk about 'functional requirements of the new system' we mean the requirements of the EC and editorial assistant from database.

In many cases when we design a database we need to design different user-interfaces for different level of users. Fortunately, because of the limited number of users we have been able to incorporate both major users the are EC and editorial assistant (EA) in the same user interface. This has reduced our design job significantly.

The most important requirement of EA was to be able to control overall procedure as she wants. This is a problem that has created many problems with the old database. With the old system procedures have been tried to be automated as much as possible, which result in lack of control form user perspective. For example when you enter a new paper in to the system, it automatically starts printing letters without even asking to the user. 50% of these letters are useless and nothing more a headache.

Another example; the old database was so rigid there was no way to change the process steps. For example you have to first enter author names, then paper title then editors, It would not let you print a letter to an editor without entering author names.

There are also some technical issues that were weakly designed with old database. For example relations were formed by first and last names which result many confusions when you have a person with 4 names. You have to enter every time exactly as you have done at the first time. Any mistake or misspelling causes of creation of a new record which results inaccurate results for the reports creations.

Report creation might be accepted as the goal of whole database design process. EC has requested 12 different reports that should be available to the user request whenever they are needed. Most of 12 reports are used annually. They show the number of papers reviewed, number of papers rejected, number of papers reviewed by each department, papers in progress, etc.

The third requirement is the service that we plan to provide to editors. With the new system editors will be able to dial-in to our system and select the referees by using our database. By this will be able to track referees and report exactly how many referees are in the review process and how many papers have they been reviewed.

Data Collection

Our data collection efforts have begun just after the first meeting for the new database design. Our first step has been to follow a paper in the process from the beginning to the end. The problem was that review processes usually take between 6 months and 2 years so it was quite impossible to see how the real process have been hold. Therefore we had to make some cut and paste that is find a paper which is just submitted and then find another which is in review process, and find another paper which is at the later stages of the review process.

Even though we have successfully did our job in terms of collecting forms, reports and process information, our success has started to haunt us.

We successfully finished early stages of the project and to make sure that we are on the right track we have kept in touch both EC and EA in a continuous fashion. They both were delighted with the results. This has followed by more requests and features which caused us enough trouble to deal with for the last six months.

With the increasing demand form users we have decided on the actual reports that are being used. We have collected as many as possible and tried to focus on them.

Design Activities

Process and interface design

As we explained before the design includes only the database part of the whole information system that deals with paper tracking system therefore we will discuss only the design of the database.

The database is formed out of two main screen:

- Main screen
- Papers screen

Main screen (appendix A, figure 1) is an interface to enter personal information, it is also a mean to search and select a person that will be used as a referee, author or editor.

Papers screen (appendix A, figure 2) is an interface to enter papers author title, referees, editors and date of receipt. As mentioned above to select any of the authors, editors or referees user needs to go through the main screen to assure that the person who is being entered has a record in our main database. This is the only restriction brought by the new database.

There are two subscreens of 'papers screen':

- Review screen
- Status screen

Review screen (appendix A, figure 3) is used when EC handles the review process by himself. It keeps track of the referees and scores sent by them. If any other editor is selected then 'Status screen' (appendix A, figure 4) handles the review process. Status screen is also used to print letters to appropriate parties.

System Components

The database system is formed of 12 different database file. As in the case of user interfaces there are two main files:

- main.dbf
- papers.dbf

All other files are connected to these two database files. More than 50 indexes have been used to speed up the search processes and also allow the relational connections.

All the files and program components resides in a Novell Network server and users can use it simultaneously. The most difficult part of multi-user environments during search processes. Each one of the user wants to be able to keep searches separate from others (a logical request), but when you program the database, you have to create search databases which you have to name differently to avoid any mix-up. Fortunately, the login environmental variables keep track of user's login names an with the help of these variables we have been able to program the database as it is requested from us.

Implementation

System construction

The system construction has begun with design of database files. Appendix B includes all the database files, their fields and respective types. After a month of work we finished the database design section and decided to move to programming and user interface design steps.

Even though we have locked the design of the database structure because of some lack of knowledge about normalization-I assume-we had problems in getting the results we expected. Therefore we had to make some changes in the database structure.

Other than those normalization problems, programming was straight forward. We first designed general browser to add remove and edit personal information. The difficulty we ran into in this stage was to add necessary procedures to be able to conduct searches efficiently requested by users and avoid multiple entries for the same person.

The next step was to create the modules for the survey entries that is supposed to be conducted in the near feature. The results of the survey will be use to find the right referee for a given paper.

We, then moved to the module that handles the review processes. As I mentioned above paper module has two sub modules, one for review processes that will be conducted by EC and one for the status handling. Review process handling part has been copied exactly from the EA's procedures. It almost looks like the forms used by EA and EC but with many added features like instantaneous reach to personal information.

The last step of the programming part has been the creation of the reports. As long as you have designed your database correctly, the report creation is a trivial issue, and it has been the same case for us. Now with the new system all of the reports can be printed in two minutes, which used to take at least two days for EA to figure out.

Technical issues

- The total size of the complete database, including database files with more than 13000 records is 11.6 Megabytes.
- A total of 311 files have been used in creation of the database.
- The technical information about 12 database files used in the system may be found in appendix B.
- There are two primary objects in the database one is the personal information and the other papers information. We created two ID's for the creation of relations. Each of the individual records is identified by a field we called 'CODE' and for the papers we used another ID field called 'Paper_code'. These fields are 8 digit character fields. These numbers are created by the system sequentially and users are not allowed to change them for the sake of safer structure. If a record is deleted then that number also is discarded. In the future we are planning the to keep track of these numbers in order to be able to use them again.

Testing, Replacement and Delivery

Testing was a continuous effort during all stages of project. We have not advanced to next level until we make sure that everything works fine. Though a problem that we did not expected has occurred that is scaling.

While we were developing first modules we limited ourselves to one hundred records. During all the programming process we used these 100 records to test our module. When we have finished our second module we have decided to use all of available records. To our surprise most of the features were not working. It took us almost a day to figure out the problem. The problem was with the 8 digit codes generating by the system.

The test process is currently being conducted by both EC and EA. We are planning to have a three month test period. During this period both old and new system will be used. At the end of 3 months if everything goes OK we will completely change to the new system.

Maintenance

The maintenance of the system will be done by us as long as we are here. Though, for the worst case, some new modules will be added to the system that will take care of the many maintenance problems. This issue is also discussed in the future plans.

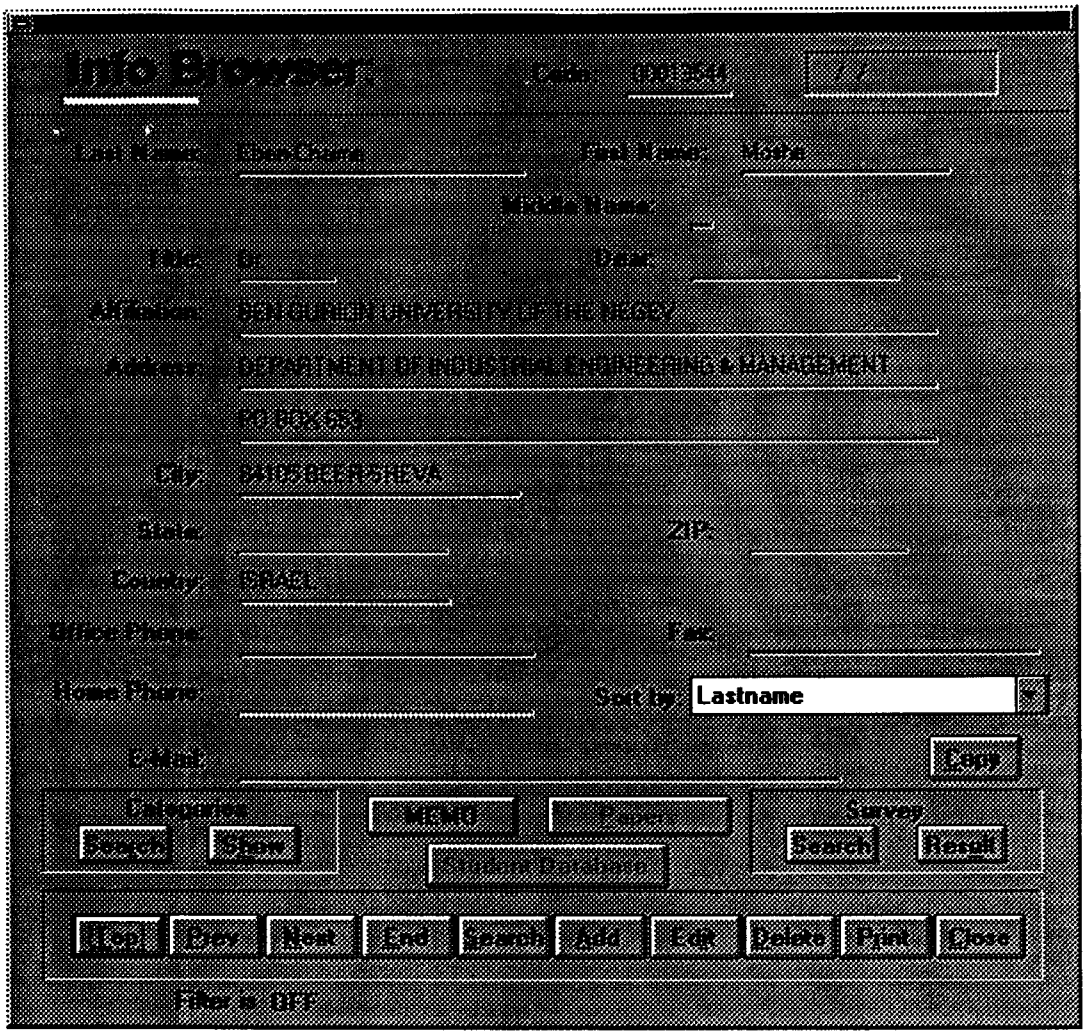
Plans for Future

Currently the system fulfills all of the required functions. Even though there are some glitches, they are not important and they do not affect the operation of the system.

Our future plans include to improve database so that it will take care of it self in terms of back-upping, correcting file structures for possible problems that might be caused because of power shortages or any other reasons.

Another issue will be the connections of other editors to our system. This system is almost finished and we are also planning the ability to e-mail paper results through the database and database will be able to receive scores automatically and update the results for future uses.

Appendix A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Elon Chaya
First Name:
Middle Name:
Title:
Dr.
Dear:
Affiliation:
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Address:
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
PO BOX 653
City:
BEERSHEVA
State:
ZIP:
Country:
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Office Phone:
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Home Phone:
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E-Mail:
Copy
Categories
Search
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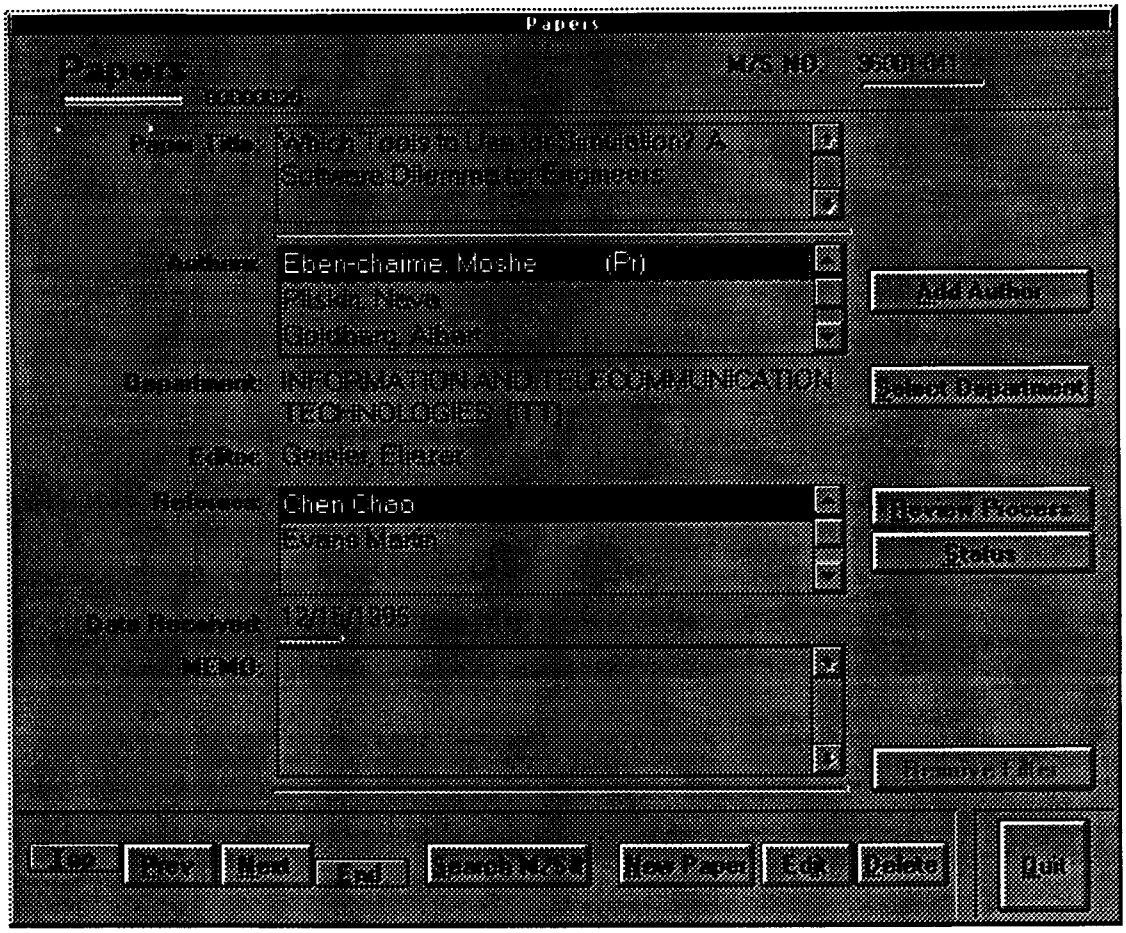
Edit
Delete
Print
Close
Filter is OFF

Figure 1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Select Department
Editor: Gonzalez, Eliazar
Reviewers: Chen Chao
Evans Mario
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Find
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New Paper
Edit
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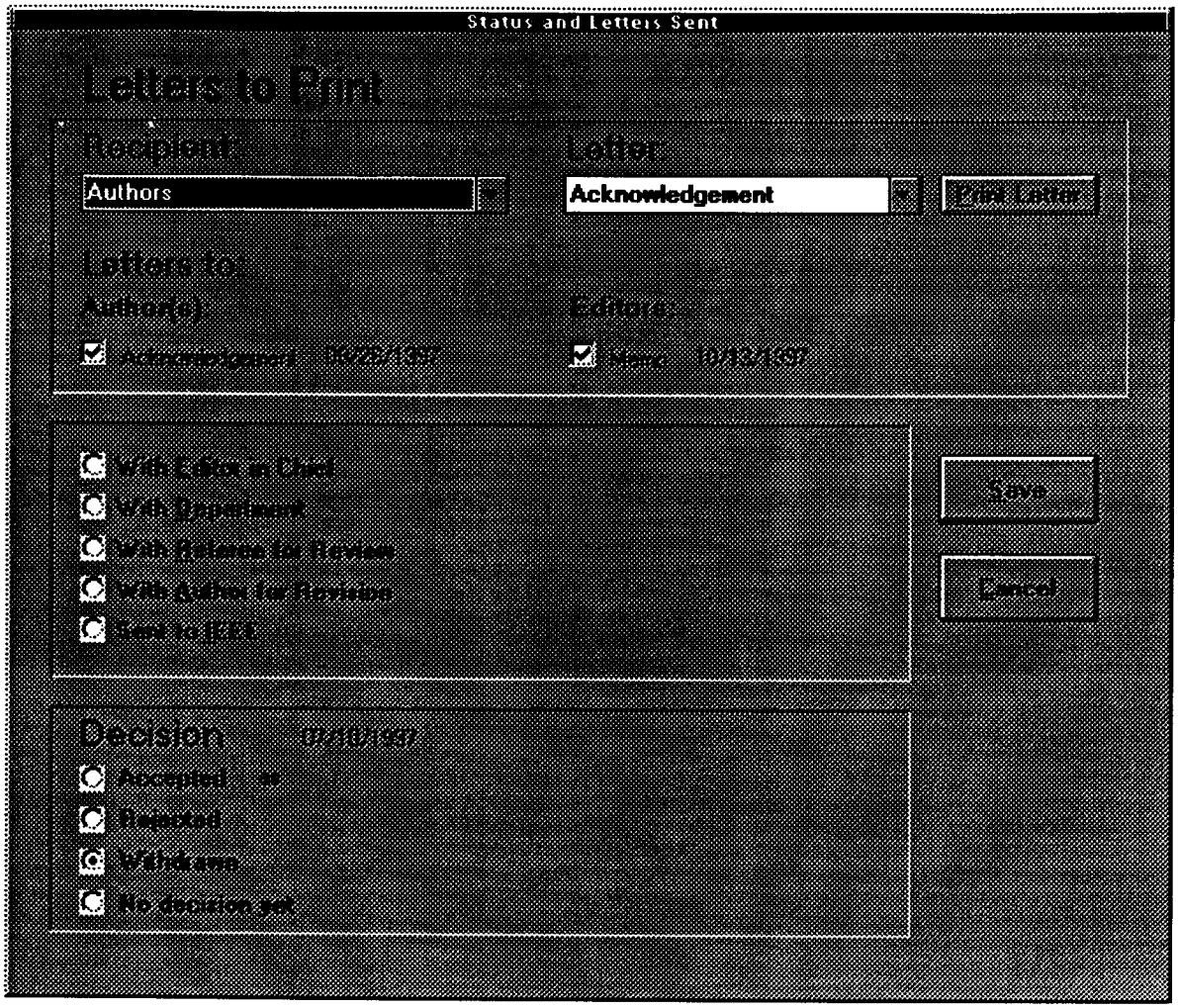
Figure 2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Rejected
Withdrawn
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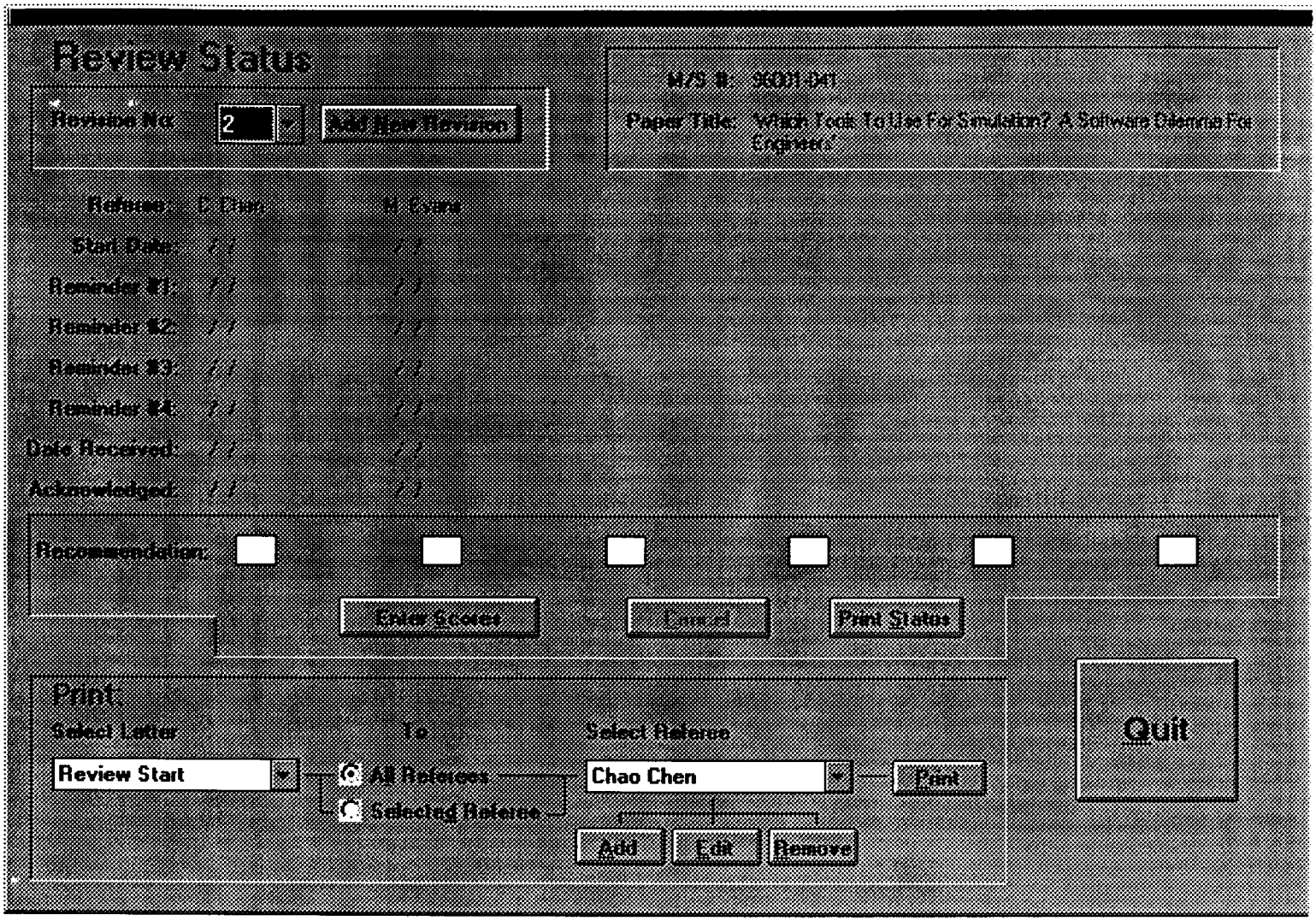
Figure 3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Start Date: / / / /
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Reminder #2: / / / /
Reminder #3: / / / /
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Acknowledged: / / / /
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Figure 4

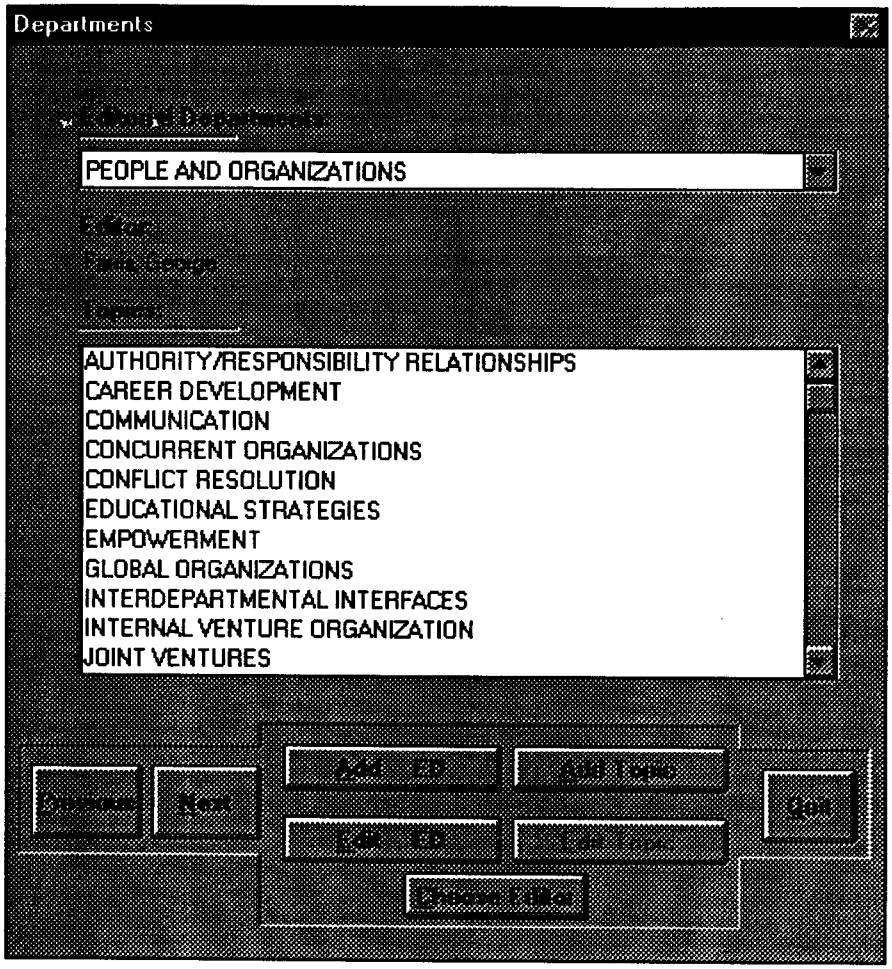
Departments
PEOPLE AND ORGANIZATIONS
AUTHORITY/RESPONSIBILITY RELATIONSHIPS
CAREER DEVELOPMENT
COMMUNICATION
CONCURRENT ORGANIZATIONS
CONFLICT RESOLUTION
EDUCATIONAL STRATEGIES
EMPOWERMENT
GLOBAL ORGANIZATIONS
INTERDEPARTMENTAL INTERFACES
INTERNAL VENTURE ORGANIZATION
JOINT VENTURES
Next
Get

Figure 5

Appendix B

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   3   DATE        Date       8          Asc    Machine
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   3   FILE        Character  8
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Code Page: 0

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5	DEAR	Character	15			
6	ADDRESS1	Character	50			
7	ADDRESS2	Character	50			
8	ADDRESS3	Character	50			
9	CITY	Character	20			
10	STATE	Character	15			
11	ZIP	Character	10			
12	COUNTRY	Character	15			
13	OFFICEPHON	Character	21			
14	HOMEPHONE	Character	21			
15	E_MAIL	Character	30			
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17	FAX	Character	21			
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Memo file block size:  64
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   4   MEMO        Memo         10
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Date of last update:    05/12/95
Code Page:              0
Field  Field Name  Type       Width   Dec   Index   Collate
   1   PAPER_CODE  Character      8          Asc   Machine
   2   AUTHOR_COD  Character      8          Asc   Machine
   3   PRIME       Logical        1
** Total **                     18
---------------------------------
Structure for table:    c:\ieee\people.dbf
Number of data records: 2
Date of last update:    04/14/95
Code Page:              0
Field  Field Name  Type       Width   Dec   Index   Collate
   1   PCODE       Character      3
   2   PERSON      Character     15
** Total **                     19
---------------------------------
Structure for table:    c:\ieee\revision.dbf
Number of data records: 119
Date of last update:    05/21/95
Code Page:              0
Field  Field Name  Type       Width   Dec   Index   Collate
   1   PC          Character      8          Asc   Machine
   2   RC          Character      8
   3   RN          Character      1
   4   STR         Date           8
   5   RM1         Date           8
   6   RM2         Date           8
   7   RM3         Date           8
   8   RM4         Date           8
   9   REC         Date           8
  10   ACK         Date           8
  11   RECCOM      Numeric        1
** Total **                     75
---------------------------------
Structure for table:    c:\ieee\survey.dbf
Number of data records: 961
Date of last update:    05/30/95
Code Page:              0
Field  Field Name  Type       Width   Dec   Index   Collate
   1   MAIN_CODE   Character      2          Asc   Machine
   2   SUB_CODE    Character      3          Asc   Machine
   3   SUR_CODE    Character      8          Asc   Machine
   4   S           Logical        1
   5   P           Logical        1
   6   B           Logical        1
   7   R           Logical        1
** Total **                     18
```

Structure for table: c:\ieee\table1.dbf
Number of data records: 8
Date of last update: 04/23/95
Code Page: 0

Field	Field Name	Type	Width	Dec	Index	Collate
1	MAIN_CODE	Character	2		Asc	Machine
2	MAIN_DESC	Character	80			
3	EDITOR_COD	Character	8		Asc	Machine
4	PAPERS	Character	3			
** Total **			94			

Structure for table: c:\ieee\table2.dbf
Number of data records: 179
Date of last update: 03/29/95
Code Page: 0

Field	Field Name	Type	Width	Dec	Index	Collate
1	MAIN_CODE	Character	2		Asc	Machine
2	SUB_CODE	Character	3		Asc	Machine
3	SUB_DESC	Character	100		Asc	Machine
** Total **			106			
