VISUAL DATABASE SYSTEM FOR EL-MANSOURA UNIVERSITY

قواعد البيانات المصورة

وتطبيقاتها على جامعة المنصورة

by

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ملخص البحث

يدور هذا البحث حول تصميم وتنفيذ قاعدة بيانات مصورة خاصة بجامعة المنصورة. وتضم هذه القاعدة معلومات جغرافية عن الحرم الجامعى والمنشآت الموجودة بداخله بالإضافة إلى بيانات نصية عن السادة أعضاء الهيئه الاكاديمية العاملين بالجامعة.

وقد تم صياغة هذه المشكلة بحيث أمكن برمجة حلها على جهاز الحاسب الآلى بسهولة، وقد تعرض البحث بالتفصيل لبيان حل المشاكل الإجرائية المتعلقة بهذه المسألة كوسائل استقاء الصور الجغرافية وإدخالها للحاسب، وكذلك الإستفادة المثلى من كروت الذاكرة المستخدمة فى تخزين هذه الصور.

وقد تم وصف (جلسة عمل) تم فيها اختبار الإمكانيات المختلفة لقاعدة البيانات المطورة، ويوصى البحث باستمرار العمل فى هذا الإتجاه بالنسبة للجامعات الاخرى ومحاولة الربط بينها عن طريق الشبكة القومية للمعلومات بجمهورية مصر العربية.

ABSTRACT

Graphical representations and its use in data bases have come into play due to the recent progress in high resolution graphics. In this paper the problem of designing and implementation of an Image Database System (IDBS) for El-Mansoura University is studied. The database contains geographical information about the university campus and information about the academic staff members in different faculties. A general formulation of the problem is introduced and implemented in an algorithmic form. The different types of data are managed in a suitable manner for visual representation. The concept of preconstructed screens is introduced and used extensively in the problem solution. A test session is provided to introduce the performance of different aspects of the developed system.

KEYWORDS: Visual Programming, Data Bases, Expert Systems,

(1) INTRODUCTION

Recent advances in technology have made high-resolution graphics an available presentation medium on mainframes and microcomputers alike. A natural consequence of this development is the flourishing of applications employing visual interactions as a means of communication between users and computing facilities.

Graphical representations and its use in data bases have come into play due to the following reasons:

1) Pictures are more powerful as a mean of communication. They can convey more meaning in a more concise unit of expression.
2) Pictures aid understanding and remembering.
3) Pictures may provide an incentive for learning to program. Pictures do not have language barriers. When properly designed, they are understood by people regardless of what language they speak.

The main concern of this paper is to develop an image database system for El-Mansoura University. This database contains a geographical maps for the the university campus and its contents. Also the system provides the user with a textual information about the staff members working in university. This paper is presented as follows: Section (3) gives a literature review of the visual databases. Section (4) gives an algorithmic formulation of the problem to be dealed with. In Section (5) the solution of the problem is introduced via the concept of pre-constructed screen and the good management of memory storage of the visual card. The performance of the different aspects of the developed system is tested via a test session introduced in section (6). The paper ends with the conclusions and suggestions for further work.

(2) LITERATURE REVIEW

In the past two decades, impressive progress has been made in providing users with fast, easy access to large volumes of actual data. Considerable progress, however, has been made in the area of providing users with convenient access to database schemes [1]. Most of the advances that have been made in the later area are based on "semantic" database models. There are two reasons for this. First, historically, semantic database models were originally introduced to facilitate the design of database schemes Chen [2], Hammer and Mcleod [3]). At that time, the traditional database models (relational, hierarchical, and network) were gaining wide acceptance as efficient data management tools. Second, since a semantic model is more structured than a record-oriented model, a visual representation of a semantic schema is more expressive and thus conveys more information quickly. In fact, since semantic model is an obvious choice for capitalizing on the ability graphic displays for exploring the semantic relationships in the schema. Hull and King in their excellent review [4], presented the fundamental concepts for semantic database modelling. Graphical representation of semantic models in an interactive database interfaces have been proposed as visual tools for scheme browsing definition [1].

Spatial data management is the technique of accessing data through their graphical representation. It is motivated by the need of a growing community of people who want to access information in a database management system but are not trained in the use of such systems. In contrast to conventional data base management systems in which users access data by asking questions in a formal query language, spatial data management systems present the information graphically in a spatial framework.

The Spatial data management concept was first proposed by Fields and Negroponte [5], and later explored by Donelson in an experimental system [6] at the Massachusetts Institute of Technology. A prototype spatial data management system built at the computer corporation of America (CCA) which interfaces to a conventional database management system was reported by Herot [7].

(3) THE PROBLEM

The problem of constructing a visual database management system for El-Mansoura University can be formulated as follows:

Given:

The following types of data are given:-

i) *Campus geographical data including a map for the whole campus.* The map contains a top view of the following locations:
   1) different faculty buildings existing within the campus;
   2) Gardens and roads;
   3) Research centers such as "university computer center";
   4) Social buildings such as "university mosque" and "academic staff club";
   5) Playgrounds and gyminesium;
   6) University hospitals and Gastroenterology center;
   7) Details layout of the different buildings such as room, halls, Labs, ... etc at each floor of the different buildings.

ii) *Academic staff data:*
   These data include a file for each staff member. This file contains data such as;
   1) Name; 2) Birthday; 3) Birth location;
   4) Academic degrees and its dates;
   5) Academic and administrative positions;
   6) Academic research interest fields.

Required:

Design a visual data base system which can be operated on the mainframes or personal computers to manage all theabove information. The developed system should have the following specifications:-

1) All the textual information such as building name and staff member name must be displayed in Arabic language.
2) The appearance of the geographical locations on the computer display must simulate the actual distribution inside the campus according to the known geographical standards.
3) Different levels of details must be available according to the user request. The transition from a specific level to another should be easy and simple.
4) The system must be designed such that no previous information or experience with database is required by the user.

All geographical information are taken from the "University Engineering Administration" drawn to a suitablescale. The staff data are taken from the different administration offices in university.

(4) THE SOLUTION

4.1. Design Considerations

The following considerations are taken while developing the problem solution:

1) The manipulated data may be categorized into two main types geographical and textual.
2) The arabic writing appears on the computer display with special magnification, fonts, and orientation is dealt as graphical information not textual information.
3) Spatial Data Management System (SDMS) should be developed to handle the geographical data.
4) Semantic Database System (SDBS) should be developed to hadle the textual information.
5) A library of subroutines should be constructed to be used frequently to manipulate the visual information via the use of the algorithmic programming languages such as TURBO-BASIC (TB) or PASCAL. These languages are not designed originally as a media for visual programming and hence the above mentioned library should be developed.

4.2. Performance Indices

It is important to build an efficient software according to specific criteria. These criteria are chosen to optimize the program speed of execution, use of computer system resources which including RAM, storage space, etc. The considered criteria of efficiency are:

(1) Easy to use: This has been achieved by decomposing the program into modules. They are linked with a pull-down menu which facilitate the program work.

(2) RAM size: This is achieved by loading only the module used by the system CPU. The other modules are not loaded into the system RAM. Also, for some data, less frequently needed like help data, will be loaded upon request.

(3) Speed: The developed software has the advantage that, when enough graphics memory is available in the adapter, it's possible to keep several screens full with data in the memory at the same time. Moving between pages does not affect their contents, and by moving from one page to another, very rapid changes can be made to the image on the screen and this

increases the speed of image handling.In this research an EGA card with 256 KB is used. This card supports two pages of visual information. Also for the image which is created using TB functions and needs a lot of time to draw it, we use non-visual page and then switch to it.

An important consideration with efficiency is that optimizing one aspect ofa program will of ten degrades another. For example, making a program executes faster means making it shorter and hence reduced facilities. The proper design of software will comprise between different criteria.

4.3. The Methodology

The basic requirement in the developed visual database system is the the display of "geometrical shapes" and "Arabic texts" simultaneously on the same screen. The authors have three directions of thinking for finding a solution for this problem;

(1) Use of CAD: Unfortunately CAD does not allow any Arabization or shading facilities. One can think to draw Arabic text through CAD (as a set of broken lines) which is a very difficult task.

(2) Use of TURBO-BASIC (TB): The TB organization is available. Graphics ability in TB is recognized, in addition to colors and backgrounds facilities. However, in our case the use of TB alone may not be sufficient to implement the complicated geometrical drawings such as the whole campus of university and the specified details associated with each building, thus a digitizer is used to help in such drawings. This requires special programs to be designed.

(3) Use of CAD and TB: An attempt to use both CAD and TB is done, because TB allows us to get into CAD and return back again using SHELL facility. Unfortunately, this approach is not practical due to the required large RAM size and long processing time.

A modified approach is proposedfor system implementation. It is based on the concept of "pre-constructed screens". According to this concept images and textual data are accumulated for providing a single screen. These images may be generated using different image acquiring systems. For example, the digitizer (scanner) is used to transfer the graphical data into a set of cartesian coordinates which can be accumulated with some textual information generated through BASIC.

4.4. Image Acquisition

The user sees Mansoura University Visual Data Base System (MUVDBS) as a set of screens. Each screen has two types of data, graphical and textual. Figure 1. shows the general method used for preparing each screen. As shown in this figure the graphical data is entered using either AUTOCAD or "Digital IBM Scanner". The two types of these graphical data are combined together and stored as a single image.

There are two types of textual data, the first is the standard keyboard alphanumeric (English or Arabic). This type is entered, as usual, directly from keyboard. The second type is the Arabic titles indicating the names of different location in a magnified and non standard fonts (see Fig. 4). The later type of data is treated as graphics and entered using a digital scanner. All the textual data are organized across the screen and displayed at the proper location after displaying the graphical data.

4.5. Program Decomposition

The basic philosophy of programming used in the developed visual database is to decompose the main program into several modules. Each module manipulates single screen as follows:

i) Displaying both the graphical data and the textual data file associated with that screen.
ii) Allowing the user to navigate across the screen using the key arrows (up, down, left, and right).
iii) At each cursor location the user has three options:
   a) To move to another location using keyboard arrows
   b) Press <ESC> key to return to the previous screen from which he came.
   c) Press <ENTER> key to advance to the next screen corresponding to the chosen location.

The visual database constructed has the "tree structure" having the following five levels;

a) *Root:* It is the main screen of the visual data base. It displays the general layout of the university campus.
b) *Branches:* There are number of branches equal to the number of buildings inside the university campus such as Engineering Faculty, Commerce Faculty, and Law Faculty.
c) *Sub-branches:* Each branch has a number of sub-branches equals the number of building blocks constituting it. As an example, Faculty of Engineering has 10 blocks.
d) *Sub-sub-branches:* Each sub-branch has a number of sub-sub-branches equals the number of floors in the same

blocks, As an example block 2 of Engineering has 4-floors.

e) *Leaves:* Each sub-sub-branch has a number of leaves equals the number of rooms in each floor. As an example the third room in the second floor is the Automatic Control&Computer Dept. Head office. The leaves are the deepest level of the tree, it is a dead end in the routing through the tree.

4.6. Software Programming

Figure 4 shows the flowchart of the main program. The first section of it corresponds to the main screen display. The second section is one of the successive screens corresponding to the different branches. This part is typical with the other types of screens. There are also a library containing subroutines which may be handled many times by the main program. As an example, the cursor movement routine and the routine used to write the different titles.

(5) TEST SESSION

The following test session is performed to show the important features of the developed software program. The opening menu provides the user with two options, one for the university campus and the other for the university staff members. If the user chooses the first option (by entering the corresponding number), then the screen shown in Fig. 3 appears. This screen introduces a layout for the whole university campus. In addition to the university badge and layout of different buildings it contains information about screen management and the cursor movement control. When the user moves the cursor using the keyboard arrows within the campus, the name of the location (in Arabic) appears in a certain window. This window is not included in Figure 3 hence the cursor (to the upper left) is out of campus limits.

If the user locates the cursor at the faculty of engineering building and press ENTER, the screen shown in Figure 4 appears. This screen represents the faculty layout. At the right rear of the screen there are four options corresponding to the four floors of the building. The user should locate the cursor over the floor of interest and press ENTER for more information. If the user chooses the first floor option the screen shown in Figure 5 appears. When the user moves the cursor across this screen, the name of the location appears in the middle. As an example, the cursor is located at the upper left section which is the faculty workshops and its name (in Arabic) appears.

If the user needs to go back to the previous screen (Fig.4), the ESC key is pressed. In a similiar manner the user can navigate in different tree levels. As an example if the user chooses the second floor of the first building, then the screen shown in Figure 6 appears. This part contains rooms of the staff members of both Control & Computer Dept, and Natural Science Dept. Another example is to go back to the campus layout screen (Fig. 3) and locates the cursor at the Scientific Computing Center building and pressing ENTER. The screen shown in Fig.7 appears showing the general layout for the single floor building and its contents.

Now, if the user returns to the opening menu and chooses the university staff member option, then he/she will enter into a complete database contains different types and levels of information. Figure (8.a) shows a list of the different scientific departments in the faculty of engineering. The user should enter the number of a specific department for more information. Figure (8.b) appears when the user enters "1". This figure shows a list of staff members in the Automatic and Computer Dept. Figure (8.c) shows more information about a specific staff member in this department.

(6) CONCLUSIONS AND SUGGESTIONS FOR FURTHER WORK

Visual programming is a good media to design and manage a database system including graphical and spatial information. Such type of databases enables the user to visualize and imagine easily the spatial layout of the described building and structure. The optimization of different computer resources with use of TURBO-BASIC programming language enables the designer to develop a relatively complex visual databases using personal computers. The concept of "pre-constructed screens" with the proper management of the storage memory of the Visual card reduces greatly the accessing time of different screens. The development of visual databases of different universities in Egypt and linking between them via the National Network of Information will be a good extension of this work.

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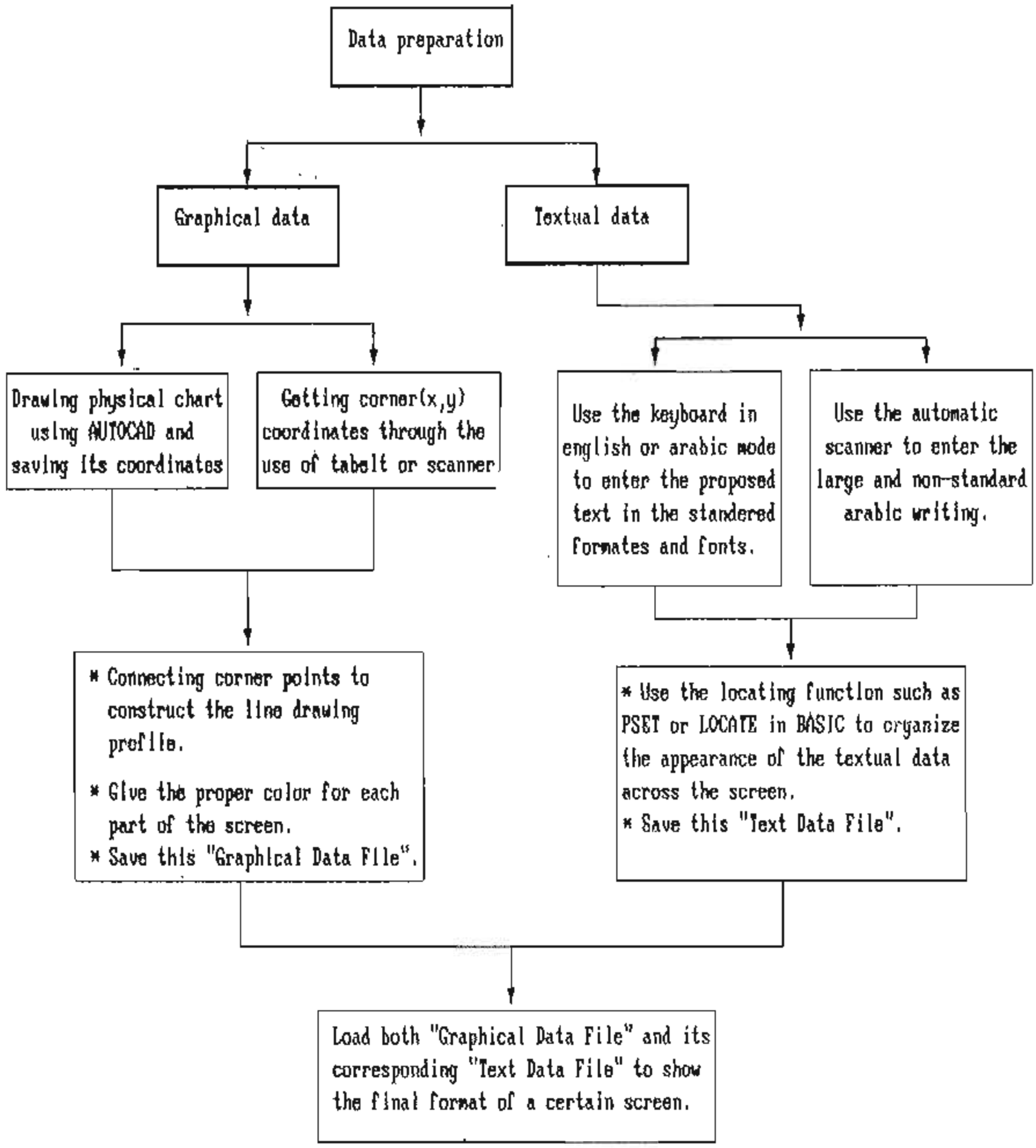

Fig (1) : Data Acquistion Methodology.

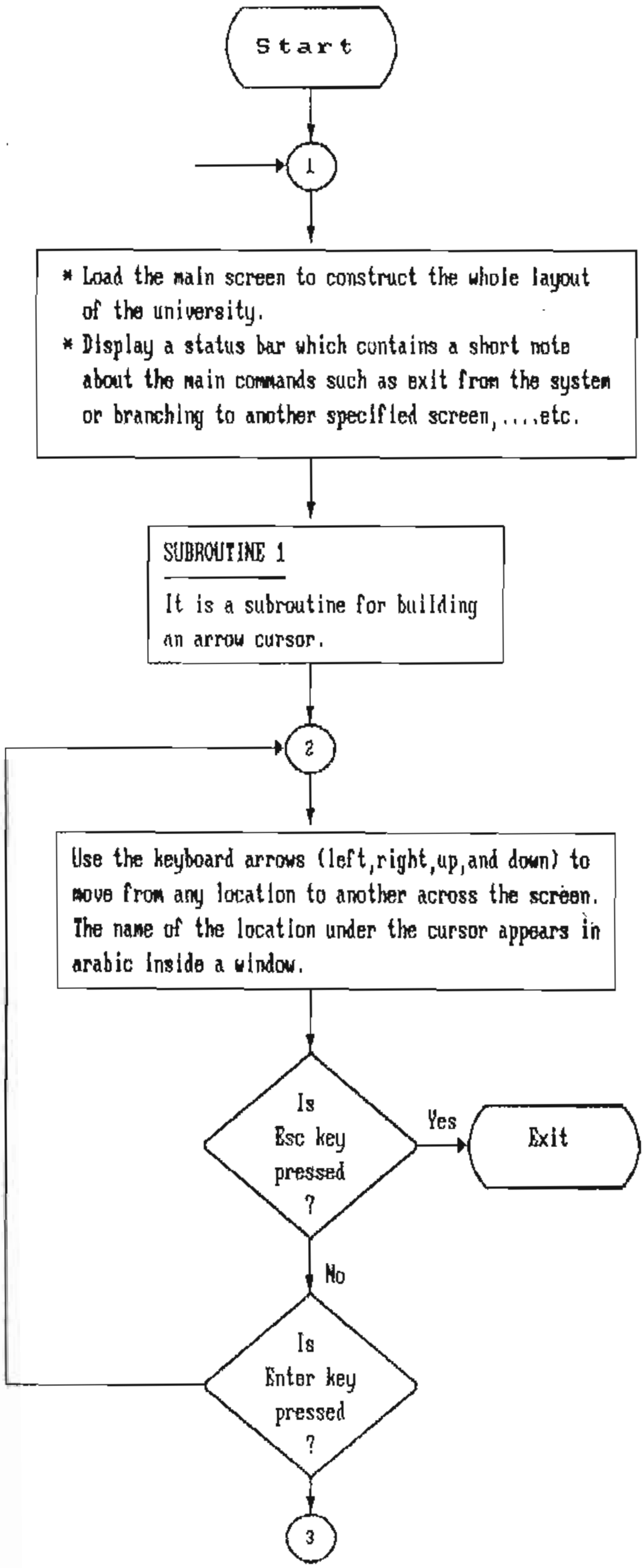

Fig (2) : Main Program flowchart.

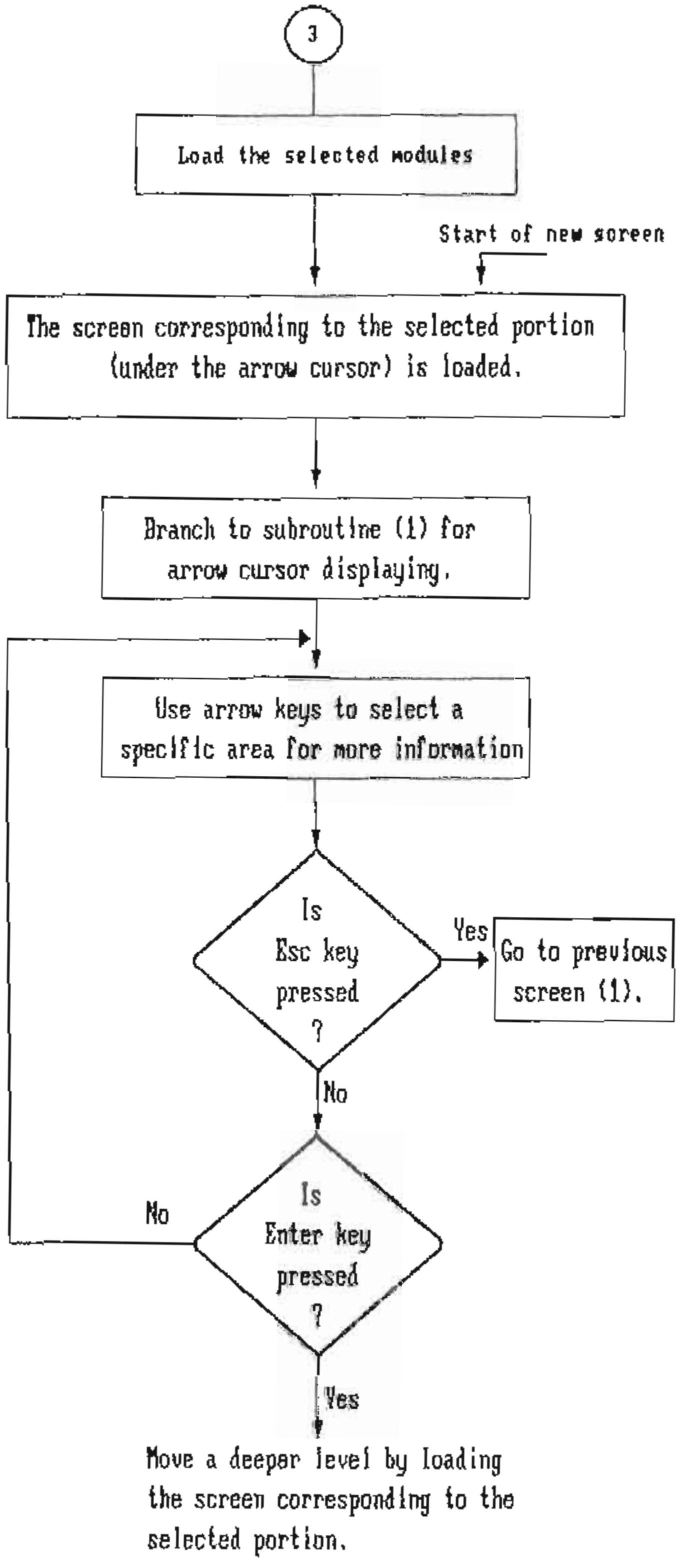

Fig (2) : Main Program flowchart ... (Cont.)

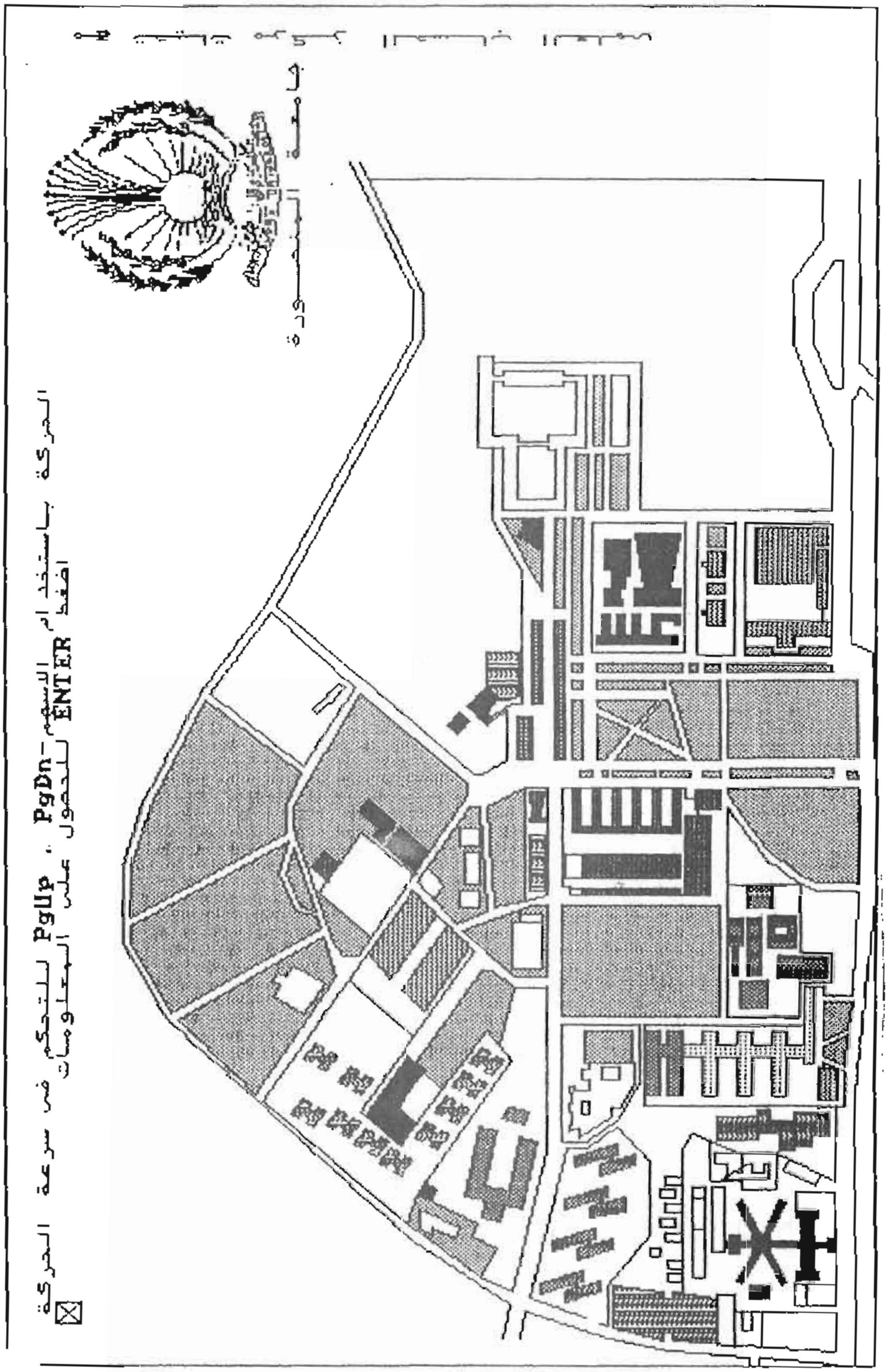

Fig (3) : University Campus.

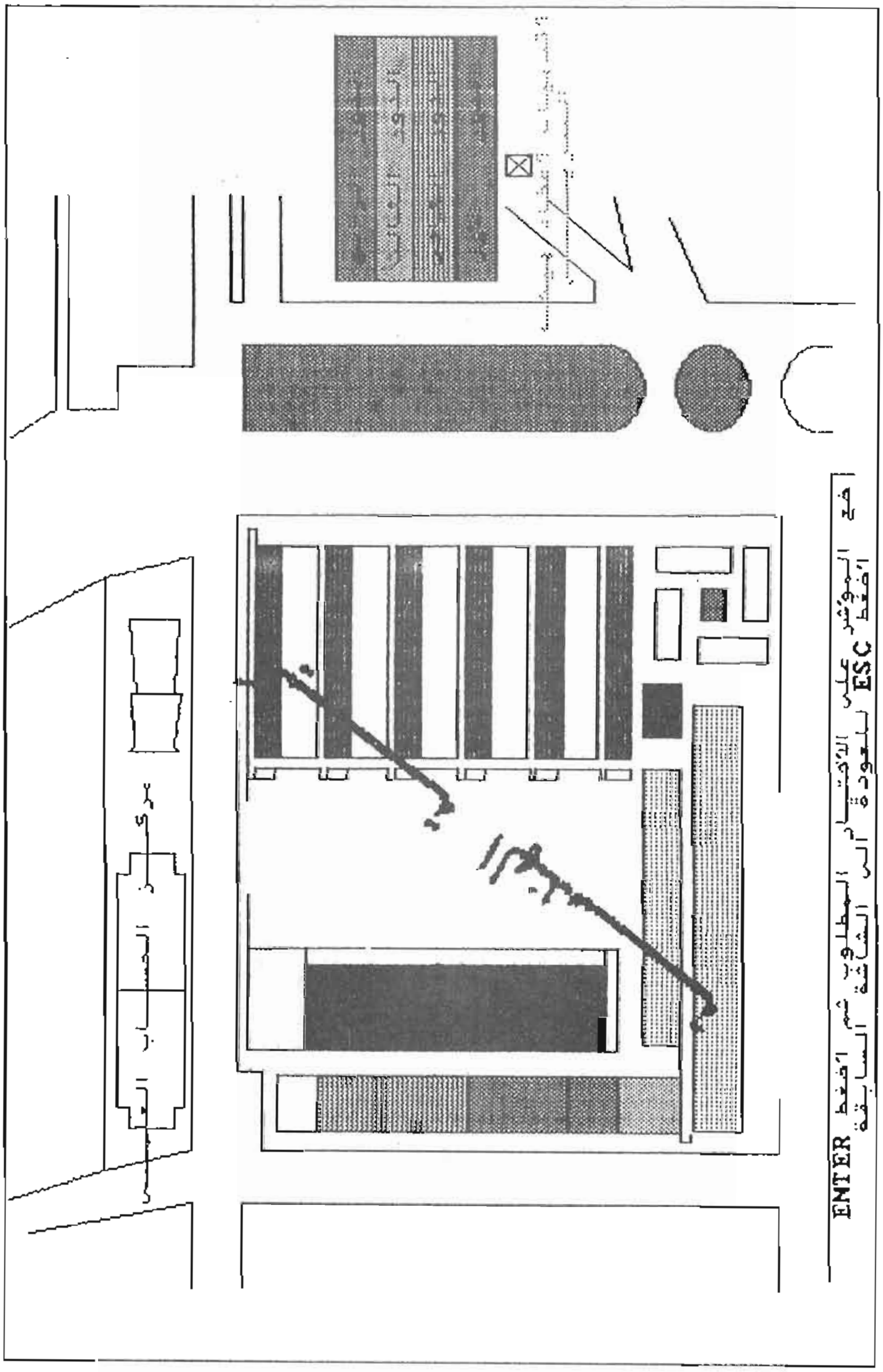

Fig (4) : Faculty of Engineering Layout.

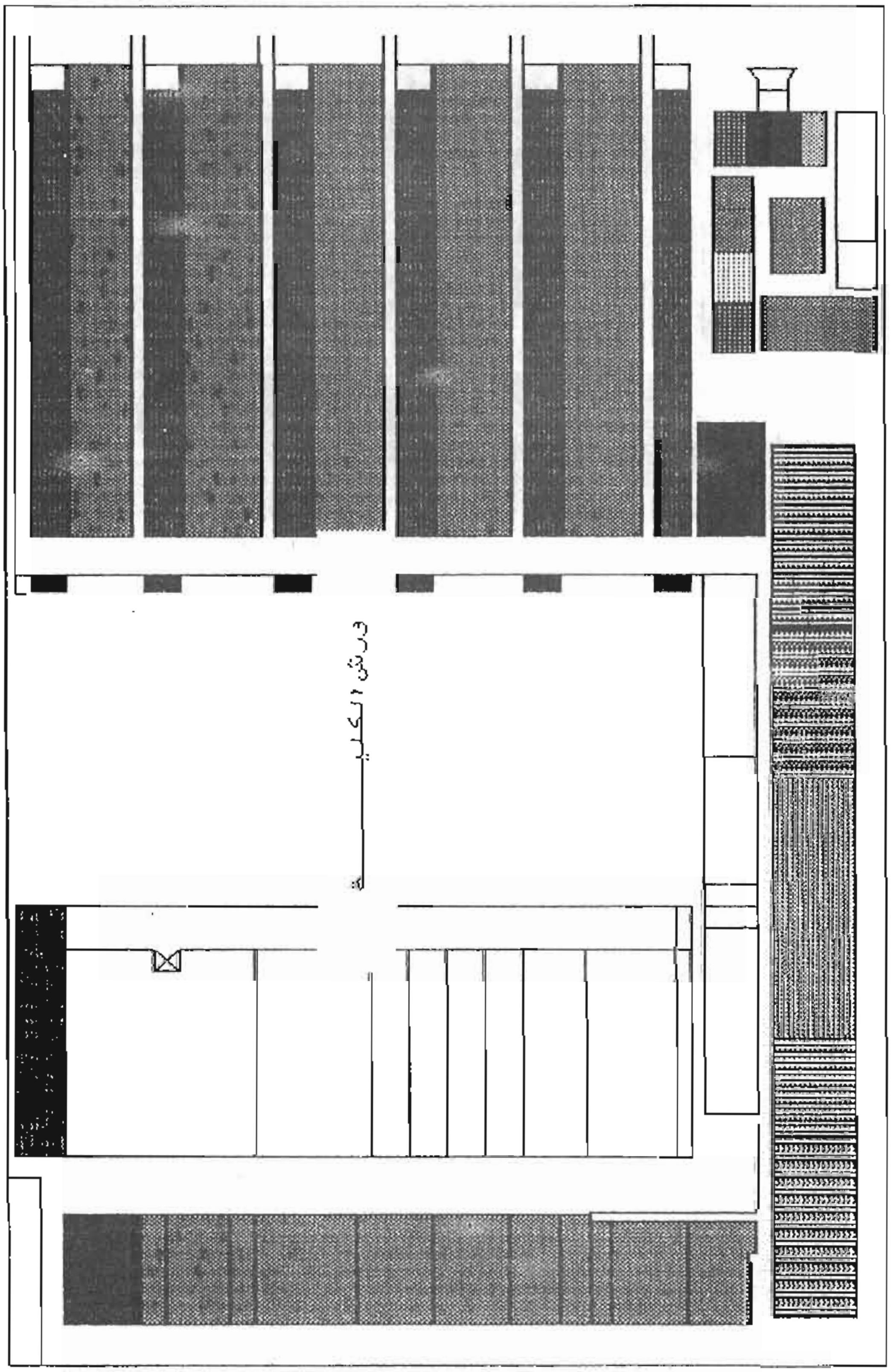

Fig (5) : First Floor Layout.

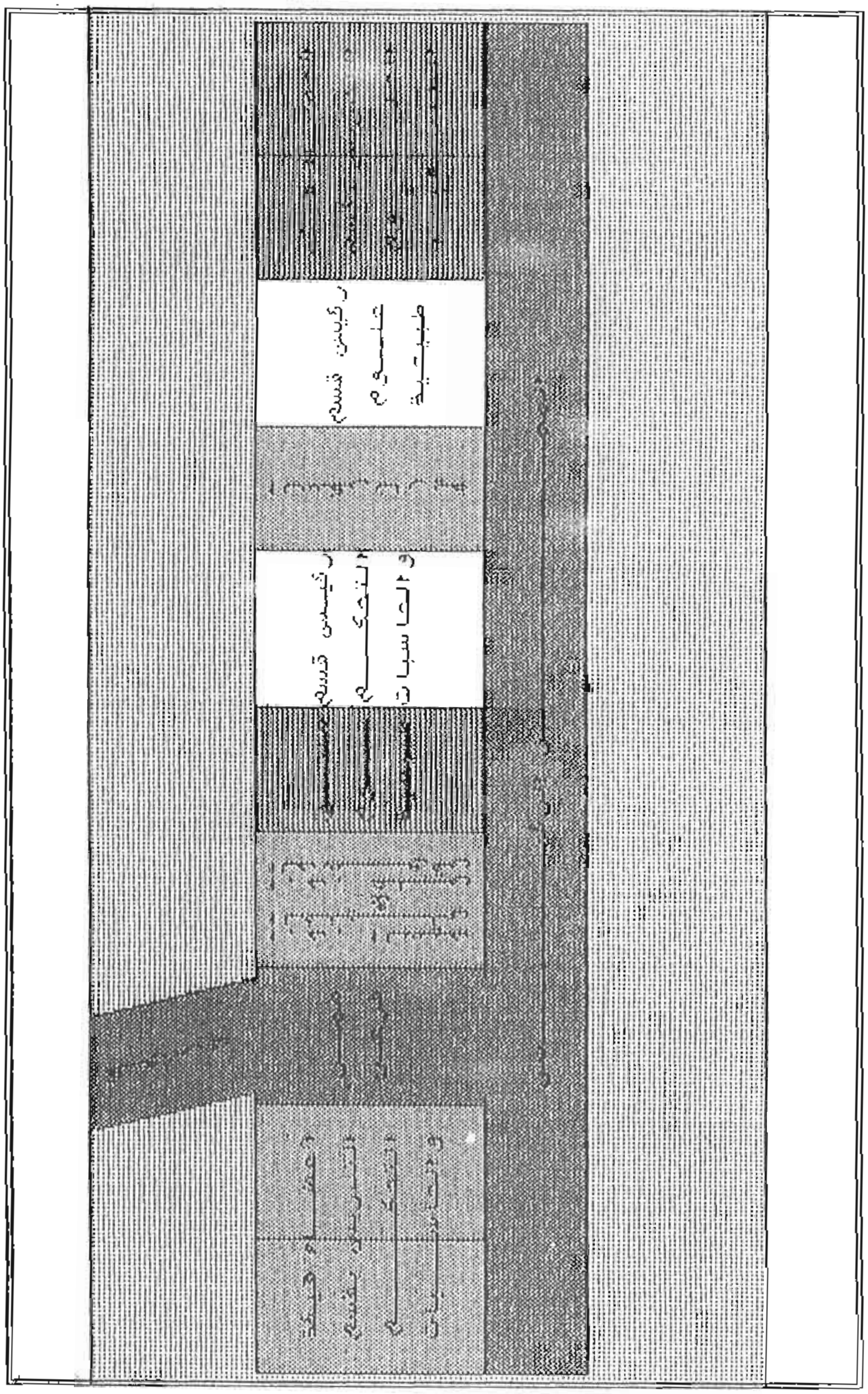

Fig (6) : Second Floor of The First Block.

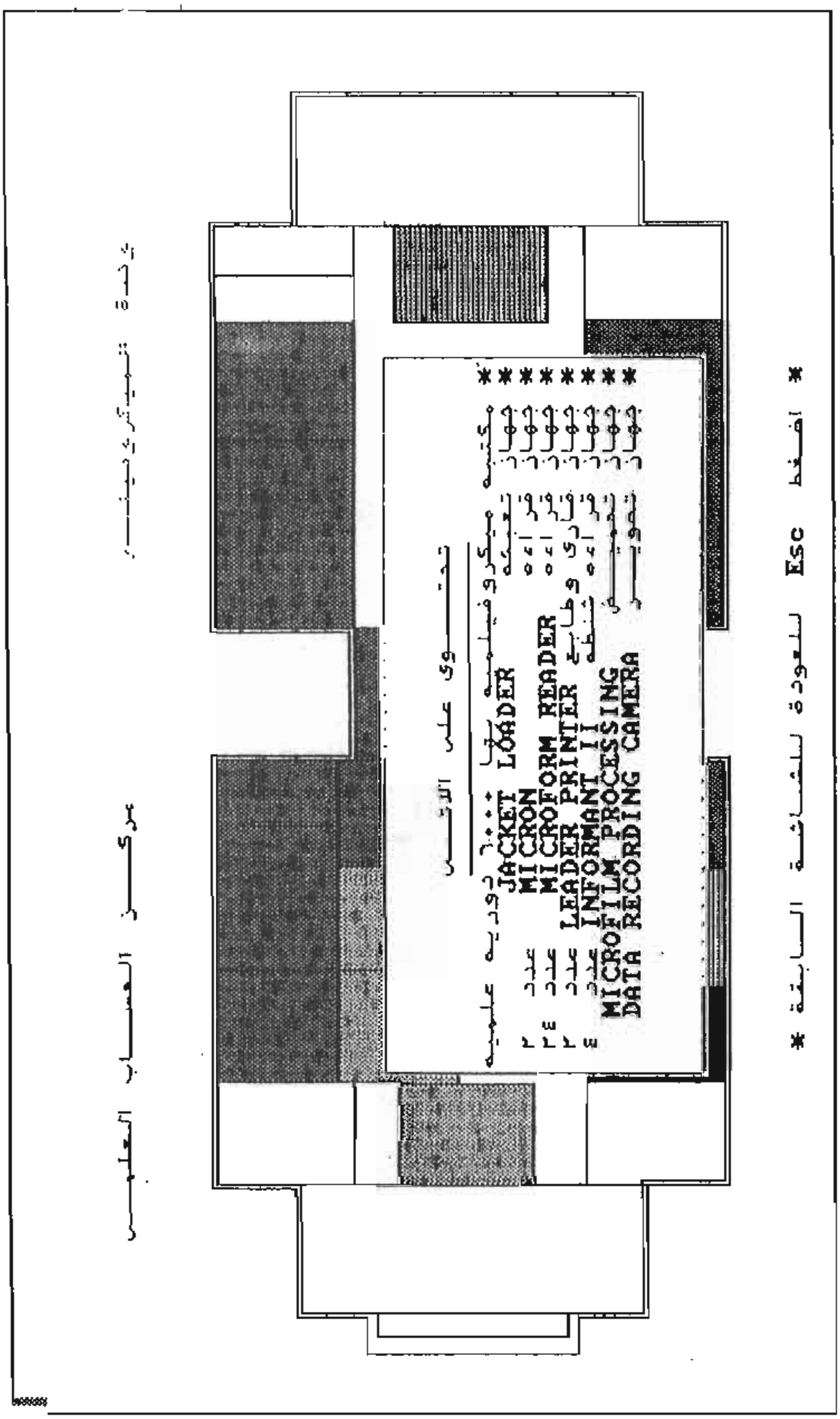

Fig (7) : The Computer Center.

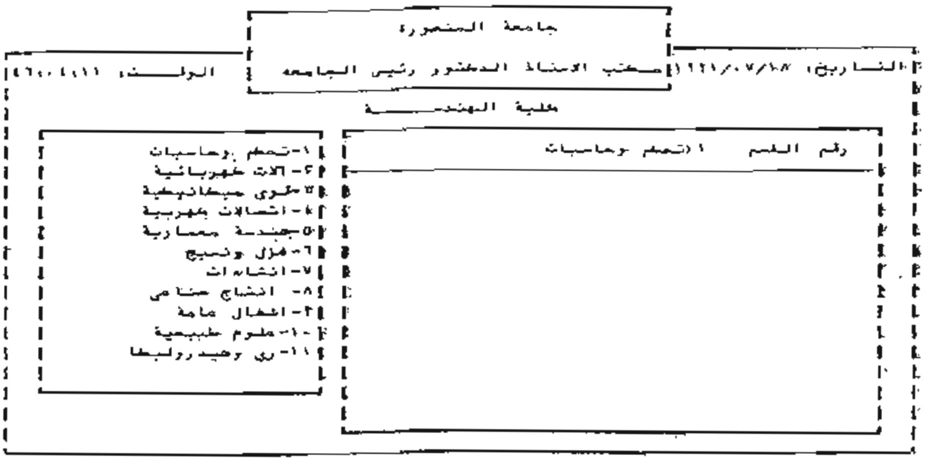

Fig (8.a)

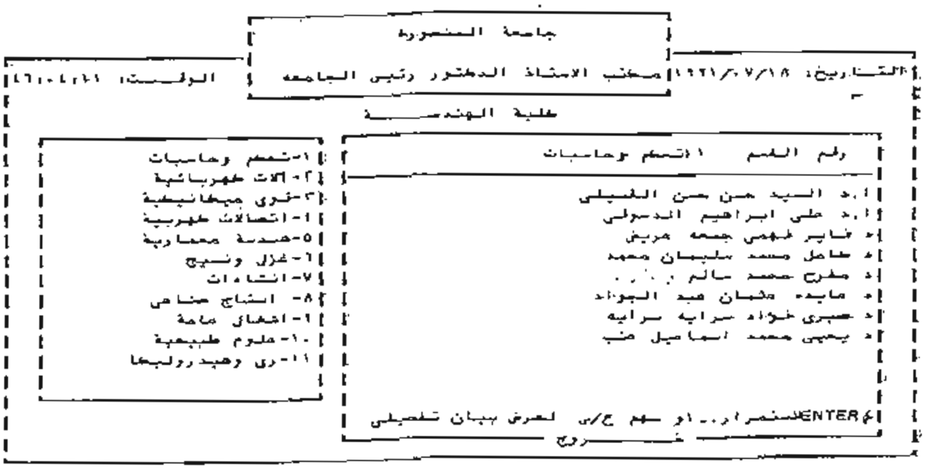

Fig (8.b)

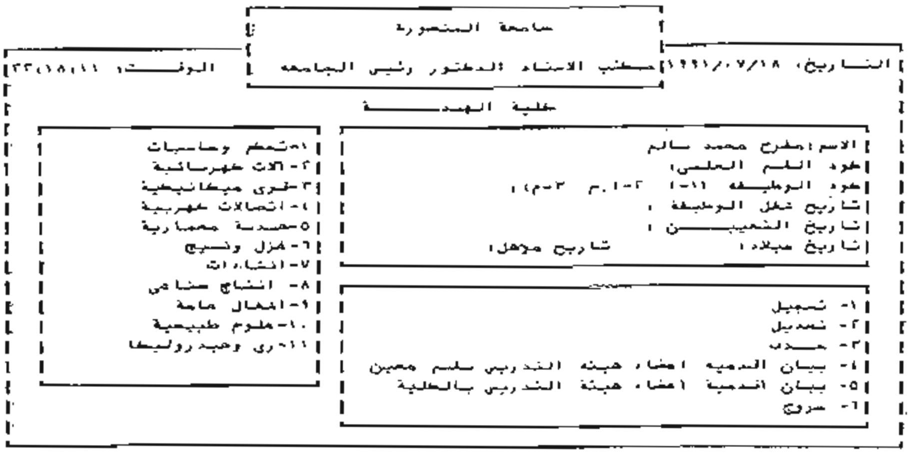

Fig (8.c)

Fig (8) : Textual Information.