

# AN EXPERT SYSTEM FOR PERSONAL COMPUTERS ERROR DIAGNOSIS AND ARCHITECTURE

نظام خبير لصيانة ومعمار الحاسبات الشخصية

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يقدم البحث نظام خبير للحاسبات الشخصية مكون من ثلاث أبعاد :  
يقوم البعد الأول بتحديد أعطال ومشاكل هذه الحاسبات ويعطى أسلوب التغلب عليها.  
والبعد الثاني نظام خاص بتدريس معمار الحاسبات الشخصية بينما يتمثل البعد الثالث في  
برنامج يغطي جميع المصطلحات الفنية المتداولة في مجال الحاسبات الشخصية. وقد تم  
تمثيل أساسيات المعرفة لهذا النظام الخبير باستخدام اسلوبى القواعد *RULES* والاطارات  
*FRAMES* وذلك بغرض التمثيل السطحى والعمقى لهذه المعرفة. كما صمم النظام بطريقة سهلة  
متميزة تمكن غير ذوى الخبرة بالحاسبات بالتعامل معه وذلك من خلال مجموعة من الشاشات  
الرائعة والرسومات التوضيحية الملونة بالإضافة الى شاشات خاصة بإرشادات عن النظام.

## ABSTRACT

In this paper, a three dimensional expert system for personal computers is presented. The first dimension is the diagnostic algorithm that is capable of tackling serious hardware problems. The second dimension is an interactive software for teaching personal computer system architecture while the third one is a glossary algorithm, which gives short notes about technical words of computer hardware and software. The knowledge bases are represented in this paper by Rule-based for surface representation and Frames for deep representation. The system is structured in such a way that even the novice user can easily find his/her way around via a set of pretty screens and visual block diagrams. Some menus are also designed to explain how to use the proposed system.

## INTRODUCTION

With the progress of personal computer Vision, graphics and CAD/CAM techniques , a wide variety of applications in various areas such as Commercial , Engineering, and Education have evolved. In Educational services many computer assisted programs have been introduced [1 - 4] to improve the quality of education at low cost. The most significant aspect of all types of such computer programs is that a user may interact with the lesson based upon individual needs by choosing his/her own sequence and direction through the material [1].

In recent years artificial intelligence is used in education through the development of educational techniques that are based on expert system approach [5 - 7]. The contents and instructional approach take the form of semantically related concepts and inference rules which result in a less rigid instructional process [7].

This paper introduces an intelligent system for error diagnosis and self teaching lessons in computer architecture of personal computer systems ,PC XT. As the visual data information is likely accepted by the user , the system is designed in such a way that information are visually displayed in a very simple and attractive form.

## EXPERT SYSTEM STRUCTURE

The expert system designed in this work consists of the following components :

- 1- A knowledge base containing ( facts , information , rules of judgement ) about the problem domain . .
- 2- An inference mechanism ( also known as inference engine , control structure , or reasoning mechanism ) for manipulating the stored knowledge to produce solutions to the problem.
- 3- A user interface ( or explanation module ) to handle communication with the user in natural language .

The knowledge base is the most important component in any expert system, However, any system will not be useful unless it has a good inference mechanism to enable it to apply the stored knowledge.

The proposed system is divided into three subsystems: Error diagnosis , glossary , and computer hardware. An inference mechanism to link and control such subsystems with a help menu is designed using disk operating system commands 'DOS'. A part of this mechanism is given below :

```

@echo off
be f1.dat
be rowcol 22,2 " "
pause
be f2.dat
be rowcol 22,2 " "
pause
:again
be menu.dat
be ask " " qphhd bright white
if errorlevel 5 goto DP
if errorlevel 4 goto RP
if errorlevel 3 goto GP
if errorlevel 2 goto HE
if errorlevel 1 goto QUIT
:DP
be cls
call dlag.bat
goto again
:RP
be cls
rem harware
hardw.exe
:goto again
:GP
call glos.bat
be cls
goto again
:HE
be cls
call help.bat
goto again
:QUIT
be cls
exit

```

where :

**diag** , **hrdw** and **glos** are three executable files containing the three subsystems

**Menu.dat** is a batch enhancer to draw the main menu of the proposed expert system ,  
and **help.bat** containing the help menu .

This mechanism produces the main menu of the proposed expert system as shown in figure(1).

There are several ways of representing knowledge, the three most popular of these are rules, frames and semantic nets. Rule-based representation is a surface representation, whereas schemes using frames and semantic nets are deep representations.

The rules used in the inference mechanism take the Rule-based form :

if error level 5 goto GP

Details about the three subsystems are given below.

### DIAGNOSTIC SUBSYSTEM

The knowledge bases used in the diagnostic subsystem are formed by obtaining information from human experts in the field of personal computer service. It is based on heuristic approach, a rule that tends to get closer to a solution, which is capable of tackling various hardware problems. The knowledge in this part is represented using both rule-based and frames schemes. The frames scheme allows a deeper insight into underlying concepts and causal relationships and facilitate the implementation of a higher-level reasoning such as abstraction and analogy. A frame is a record like data structure, a form for encoding information on a stereotyped situation, a class of objects, a general concept or a specific instance of any of these. Figure(2) shows a frame representation of part of the hierarchy of the diagnostic subsystem. The figure shows one frame representing a particular type of problem (display problems, keyboard, mouse, mouse or problems (start up problems, run problems, keyboard problems, display problems, other problems). Associated with each frame is a set of attributes (the descriptions or values of which are contained in slots). Slots can also store other information. The strength of frame-based systems derives from this hierarchical structure which enables frames to inherit attributes from other frames located above them in the hierarchy.

Rule-based is used to represent information stored in slots. Rules are modular "chunks" of knowledge of the form 'IF Situation THEN Action'.

Example of rules used are :

IF error code = 201 THEN CHECK RAM

**IF POWER ON AND NOTHING WORK THEN CHECK CLOCK GENERATOR OR BIOS**

### **IF KEYBOARD DOES NOT RESPOND THEN CHECK SYSTEM OR KEYBOARD CHIP**

The diagnostic subsystem helps the user in repairing most of the trouble shootings that may occur in a PC set without any external help.

The program is designed in such a way that a dialogue between the system and the user is started and continued until the algorithm identifies the error and gives advises for repairing. Samples of the errors that may occur in the PC are shown in figure (3).

### **HARDWARE SUBSYSTEM**

The hardware subsystem describes the personal computer organization. In this system the knowledge is represented in a frame schemes and starts by displaying a help menu to guide the user in going through the program, followed by a block diagram of the system mother board as shown in figure (4). For example the frame of 8088 processor (control unit, ALU, INSTRUCTION register, program counter) represents a particular part of the system motherboard. Another frame is the motherboard, clock generator, 8087 coprocessor, 8088 processor bus controller,.... The key board arrow keys are used to enable the user to move through the mother board screen. Details about any particular part of the mother board can be obtained by moving the "cursor" to that part and press ENTER key. Another screen, representing another frame level containing more information for the selected part, is then displayed in a very attractive form, the arrow movements are also used to further down Frame levels. Some of the information, that can be obtained, are shown in figure (5).

### **GLOSSARY SUBSYSTEM**

The glossary subsystem gives short notes about technical words which are commonly used in computer field. The system is written in COBOL language to take the advantages of indexed files. The technical word is recorded as a master key on a record containing three fields holding the description of the word. Each field of the three is displayed on a separate line on the screen. The system has four functions insert, update, and delete. These functions enable the user to insert or delete any information. The user can also update any information he wants or he can get short notes of any technical word in the subjects of personal computer software and hardware. The main menu of the algorithm is shown in figure (6).

### **CONCLUSIONS**

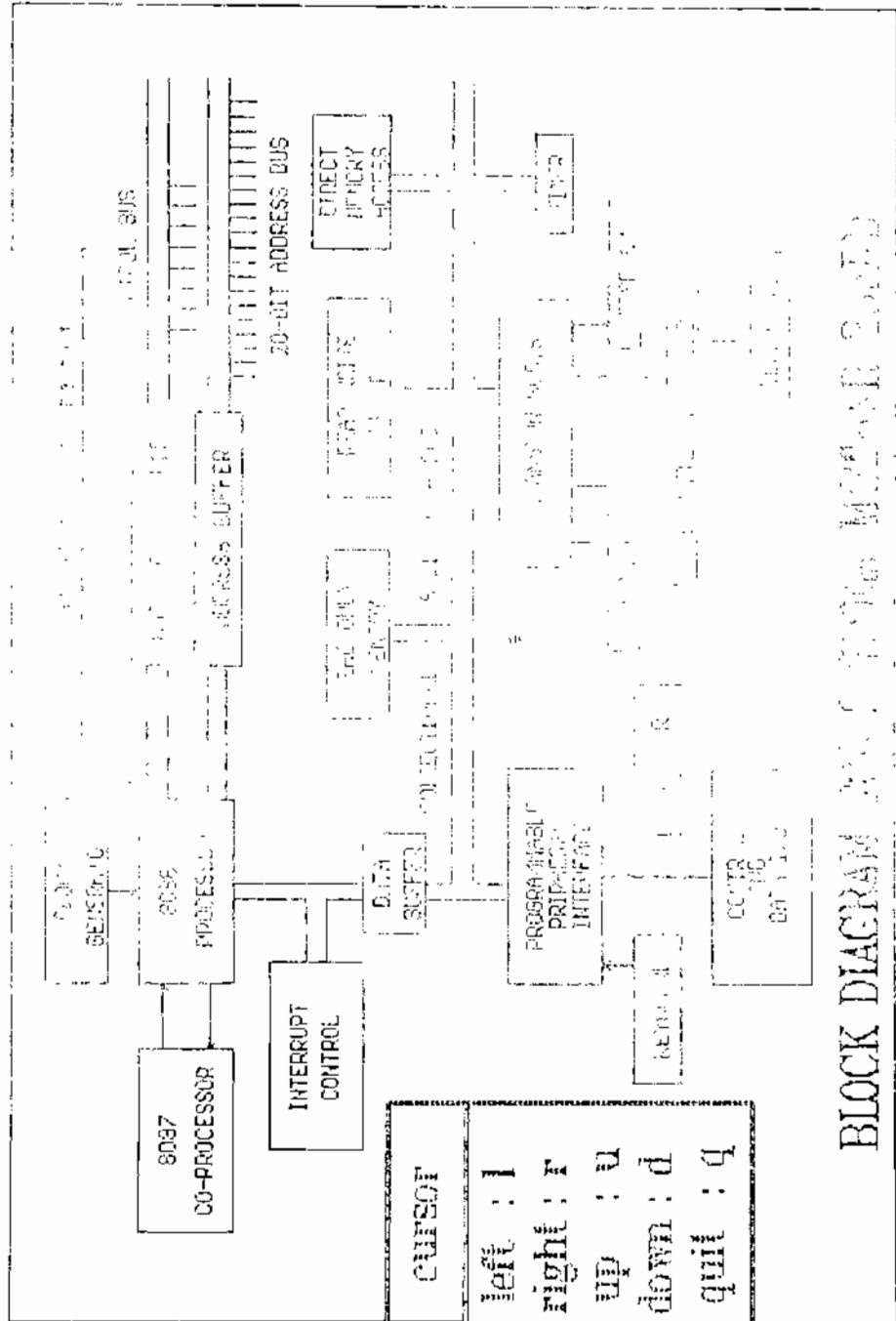
An expert system for the error diagnosis of personal computer systems is designed. The system can also deal with the knowledge representation and the teaching strategy of personal computer architectures. In addition, there is a third module that is capable of describing technical words of computer software and hardware. Both Rule and Frame

schemes are used in representing the system knowledge . This way of knowledge representation , surface and deep forms , accelerates the overall system processes.

The system is designed in such a way that a novice user can use it through a set of pretty screens and visual block diagrams.

## REFERENCES

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BLOCK DIAGRAM OF THE MICRO-PROCESSOR

FIGURE ( ) : MICRO-PROCESSOR ARCHITECTURE

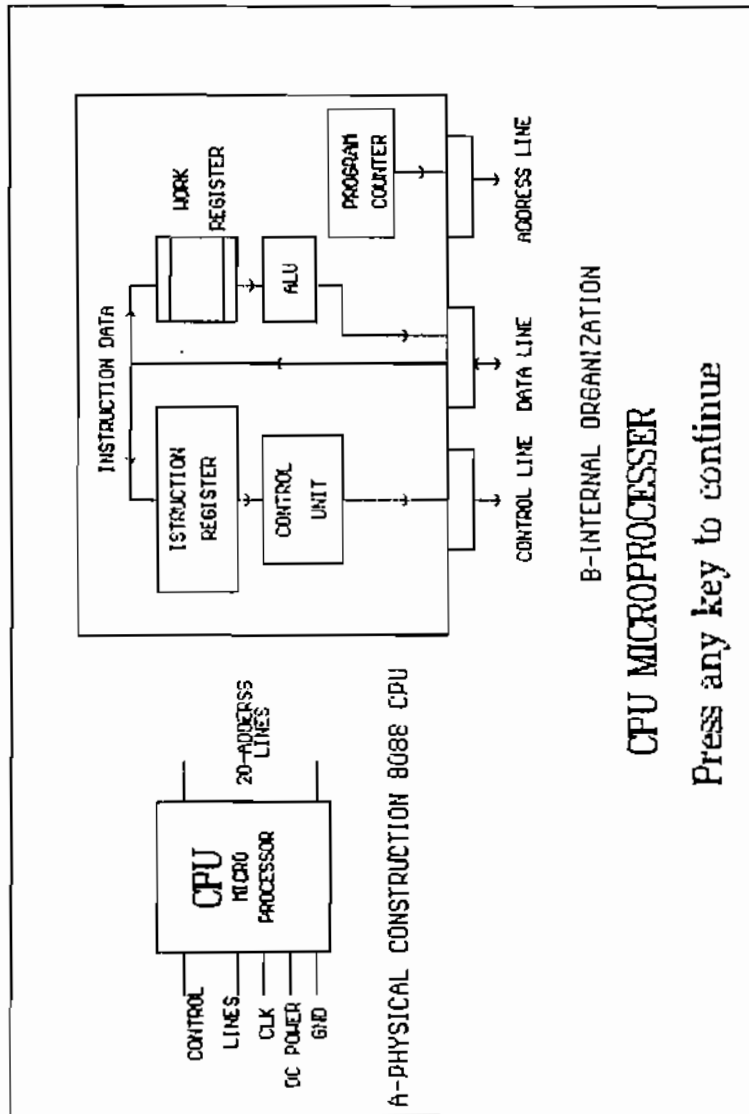


FIGURE (5): 8088 PROCESSOR

Press any key to continue

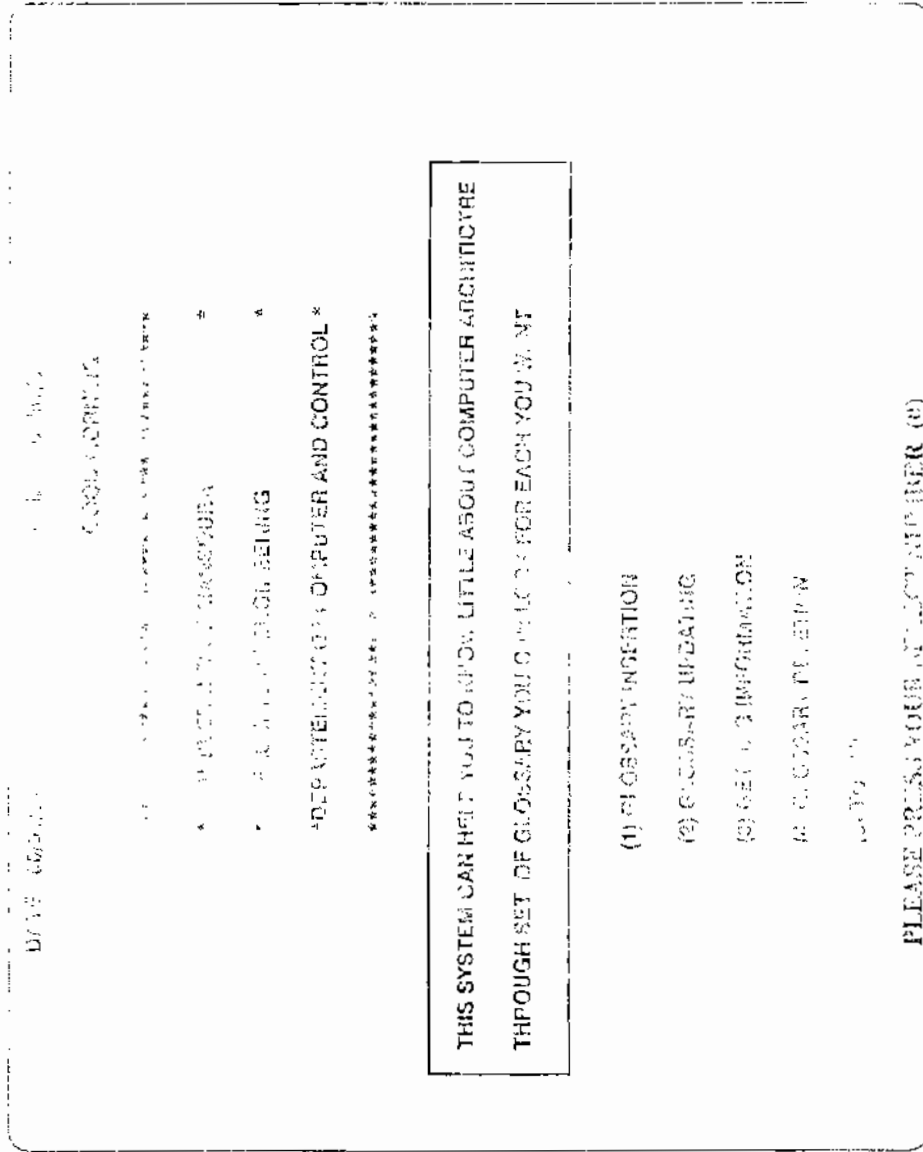


FIGURE (6): MAIN MENU OF GLOSSARY SUBSYSTEM