Expert System Designed to investigate Some Electronical Faults in TV. set

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Abstract

The research aims to design and implements an expert system tool used in some televisions faults diagnosis domains. The intended purpose of this tool is to assist those who have no wide experience in these domains.

The designed system gives the ability to build the expert system in one of the diagnosis domain. The knowledge built under team of supervisions of domain expert. The produced system is experimented in real life on the television device form type (CTO-N) under the supervisions of domain experts, too.

The generated system cans interaction with user via friendly and easy to use interface using a simple form of menu driven style. The system is also capable to give conclusion throughout questions and answering technique.

The system is also offers some flexibility in updating some of its procedures, especially the procedure related to system- user interface and that dives it the ability of future extensions to follow the large developing on expert system projection.

The system is written using TURBO_PROLOG on IBM compatible PC.

الخلاصة

يهدف البحث الى تصميم وتنفيذ نظام خبير لبعض تشخيصات اعطال جهاز التلفزيون.ولا يشترط لمستخدم النظام امتلاك خبرة كبيرةٍ في مجال الانظمة الخبيرة لكي يستخدم النظام .

يوفر النظام المصمم امكانية ادخال المعرفة المطلوبة من خلال الشخص او مهندس المعرفة, وقد بنيت هذه المعرفة بالتعاون مع مجموعة من خبراء المجال وقد تم تجريب النظام المولد في الحياة العملية على جهاز التلفزيون من نوع (CTO-N) وباشراف متخصصين في المجال.

يستطيع النظام المولد التخاطب مع المستخدم من خلال واجهات سهلة وبسيطة وذلك من خلال استخدامها لنوذج بسيط من النوافذ.كذلك يستطيع النظام من اعطاء الاستنتاجات عن طريق تقنية(السؤال والجواب).

يوفر النظام بعض المرونة في امكانية التحديث على بعض اجراءاته وخصوصا الاجراء الخاص بتفاعل النظام مع المستخدم مما يعطيه من امكانية التوسع المستقبلي لمواكبة التطور السريع والكبير في توليد الانظمة الخبيرة.

تمت كتابة النظام بلغة TURBO-PROLOG , ويحتاج النظام الى حاسبة مايكروية متوافقة مع حاسبات IBM .

1- Introduction

Expert systems (ES) are programs that are constructed to do the activities that human experts can do, such as: design, plan, diagnose, interpret, summarize and give advice. [Abbas &Hassain , 1998]

Expert system has emerged as a successful branch of AI with the aim to emulate human expertise in a focused area.

The expert system is a program designed specially in a particular subject. And it may be called (knowledge Base System), the expert system consist of (knowledge Base) containing special facts in a particular domain beside the (heuristic) or the special rules using this facts. Using expert system, to make expert decisions in a domain where it is possible to enumerate every potential solution and then choose among possibilities to some ranking method.

The theory of (ES) is to use it in special domain when there is no human expert also it was used in applications needed mechanism that man cannot afford them.

The expert system allows the system designer to represent human expert performance of some well-defined topic in a natural manner.[William&James, 2005)].

There are many expert system used in the diagnosis such as (MYCIN, PUFF, PIP, CASNET, KAS).

In this paper, we try to describe the structure and developing exert system, which demonstrate how expert system technology can be used to simplify our life and can be integrated with other computerized tools to solve computer problems.

2- Artificial intelligence and expert system

Artificial intelligence is a young and promising field of study whose primary concern is finding an effective way to understand and apply intelligent problem-solving, planning, and communication skill to a wide range of particular problems. [George & William , 1998]

AI programs deal with complex problems that are often poorly understood, for which there is no crisp algorithm solution, and that can benefit from some sort of symbolic reasoning. Expert system is sort of a large unit in AI programming.

Expert system is computer applications, which embody some non-algorithmic expertise for solving certain type of problems. For example, expert systems are used in diagnostic applications, servicing both people and machinery. They also play chess, make financial planning decisions, configure computers, monitor real time systems, under write insurance policies, and perform many other services which previously required human expert is.[Morrill , 1998]

3- The Architecture of Rule-Based Expert systems.

Fig.(1) shows the most important modules that make up a rule-based system.[George & William , 1998]

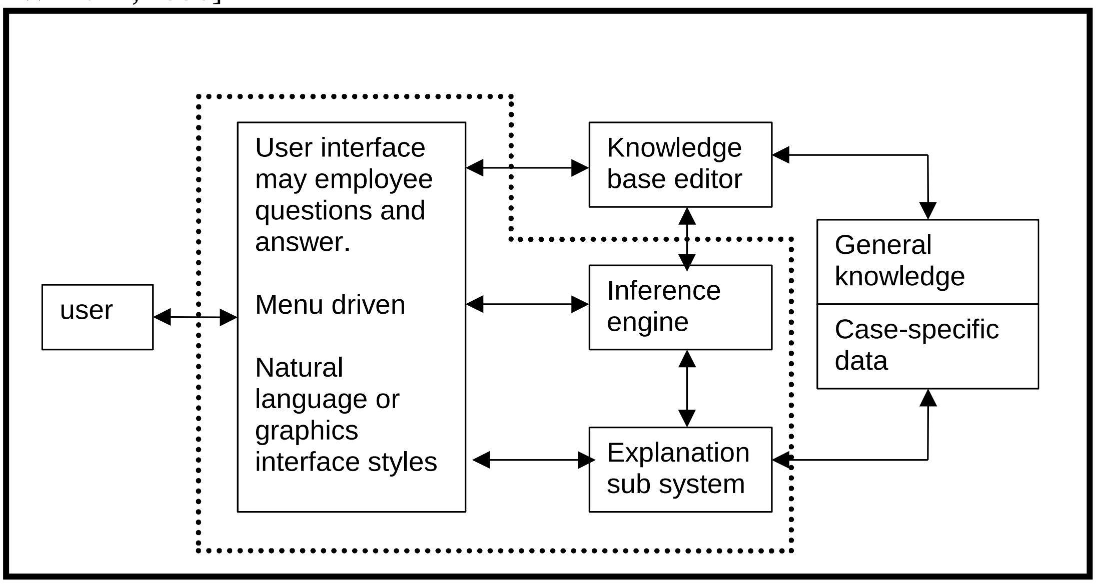


Fig. (1) Architecture of Typical Expert System

4- Forward and Backward Chaining.

There are two common and characteristics ways of deploying rules in experts systems. They are called forward chaining and backward chaining. Each strategy is the method of choice in certain situation.

The forward chaining sometimes called data driven reasoning, which takes the fact of the problem and applies the rules and legal moves to produce new facts that lead to a goal; goal –driven reasoning or backward chaining focuses on the goal, finds the rule that could produce the goal, and chain backward through successive rules and subgoals to the given facts of the problem.[Elaine,1983]

Data driven search is appropriate to problem in which all or most of the data are given in the initial problem statements. There are a large number of potential goals, but there are only a few ways to use the fact, and it is difficult to forma goal or hypothesis.[Elaine, 1983)].

Goal Driven search is suggested if there are a large number of rules that match the facts of the problem and thus produce an increasing number of conclusions or goal, and problems data are not given but must be acquired by the problem solver. In this case, goal driven search help guide data acquisition.

Fig. (2) illustrate the difference between forward and backward chaining system for two simplified rules. The forward chaining system starts with the data of a=1 and b=2 and uses the rules to derive d=4. The backward chaining system starts with goal of finding a value for d and uses the two rules to reduce that to the problem of finding values for a and b.[Macellus, 1989]

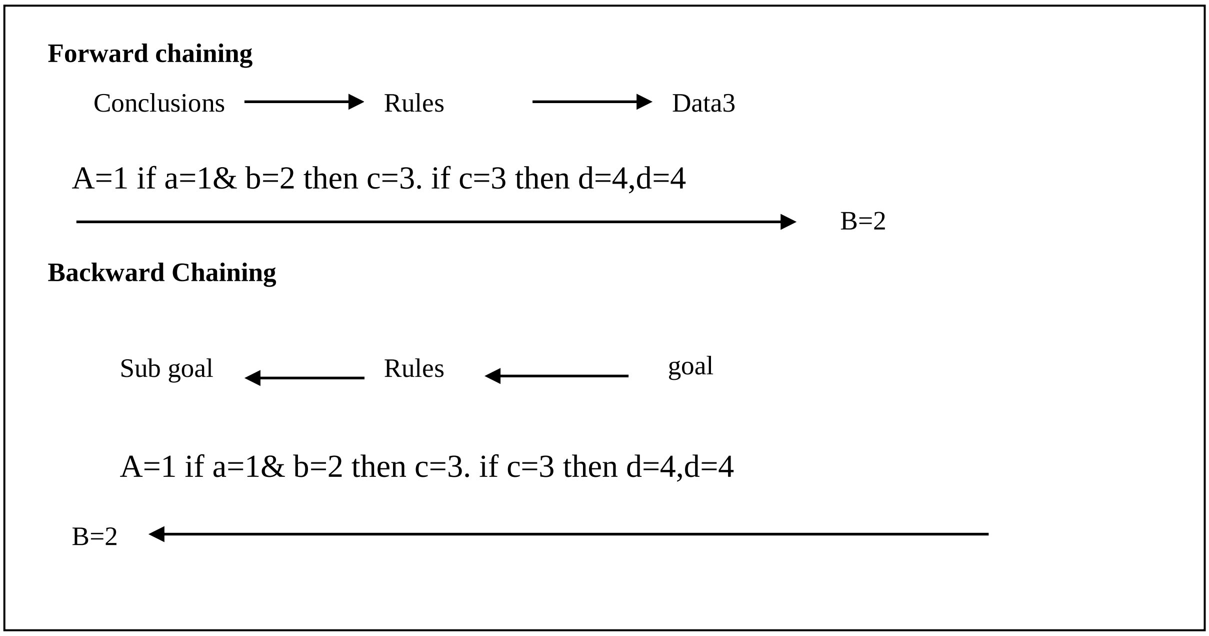


Fig.(2) difference between forward and backward chaining.

5- Problem Representations.

The problem solving methods depends on the problem representations which depends search technique using state space.

The state space is commonly identified with a directed graph in which each node is a state and each are represents the application an operator transforming a state to a successor state.

A set space of a problem employs two kinds of entities:-

a- States which are data structures giving “snapshots” of the condition of the problem at each stage of its solution.

b- Operations which are means for transforming the problem from one state to another

6- Search Methods.

Every search process can be viewed as a traversal of a tree structure which each node (represent a problem state) and each arc (represents a relationship between the state). The search process must find a path or paths through the tree that connect an initial state with one or more final state.[Morrill ,1998)]

Search is a general mechanism that can be used where no more direct method is known at the sometimes it provides the framework into which more direct methods for solving sub parts of a problem can be embedded.[Elaine,1983]

6- 1 Breadth First Search (BFS).

The Breadth First Method expands nodes in order of their proximity to the start node measured by the number of arcs between them. In other words, it considers every possible operator sequence of level (n) before any sequence of level (n+1). Thus, although the search may be an extremely long one, it is guaranteed eventually to find the shortest possible solution sequence my solution exist show fig (3).[Morrill, 1998)]

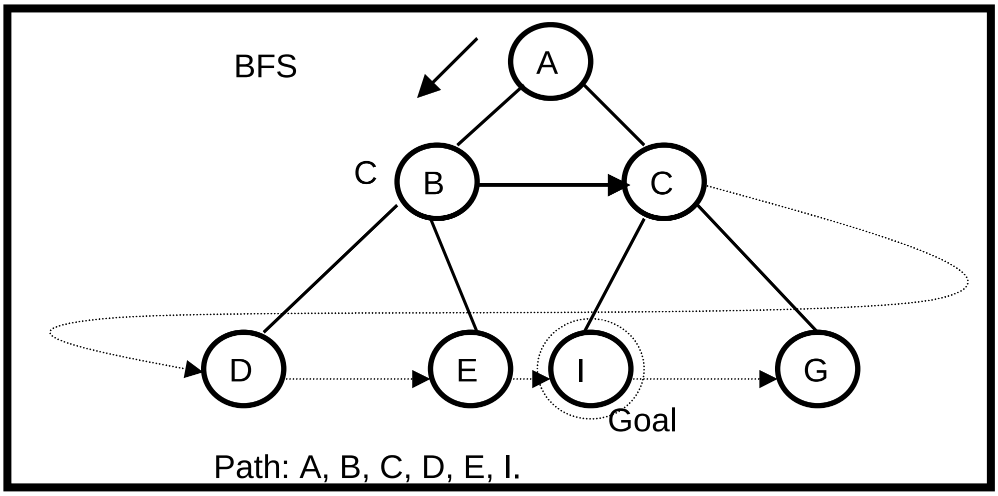


Fig.(3) Breadth First Search Tree.

6-2 Depth First Search (D.F.S.)

In depth-first search, when a state is examined, all of its children and their descendants are examined before any of its sibling. DFS search goes deeper into the search space whenever this is possible. Only when no further descendants of a state can be found are its siblings considered. To find the shortest possible solution sequence my solutions exist show fig. (4).[Morrill ,1998)]

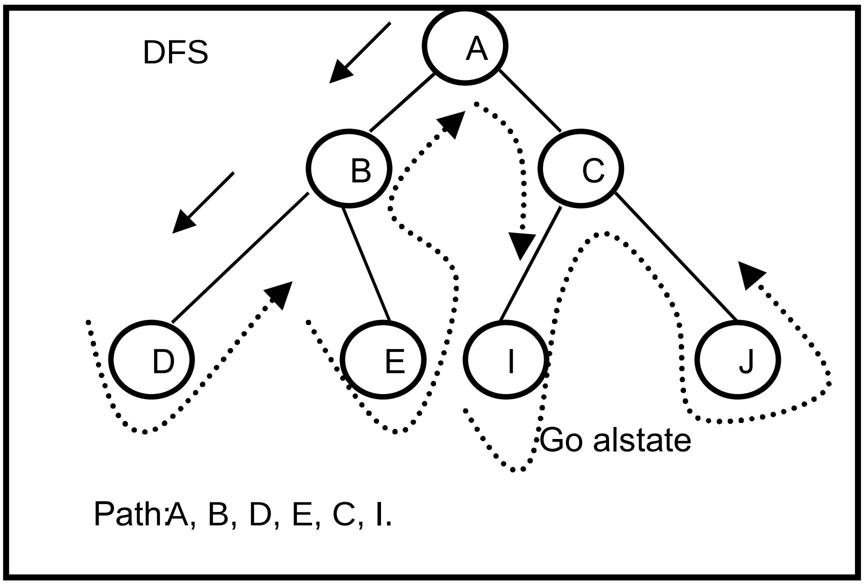


Fig.(4) Depth First Search Tree.

7- Major Stages for Building Expert System

The system builder proceeds through five stages before producing an expert system. These stages can be characterized as problem identification, conceptualization, formulation, implementation, and testing.

8- Architecture of the System and Implementation-

The architecture consists of three main parts see fig.. (5):

1-User interface.

2-Knowledge base.

3-Inference engine subsystem.

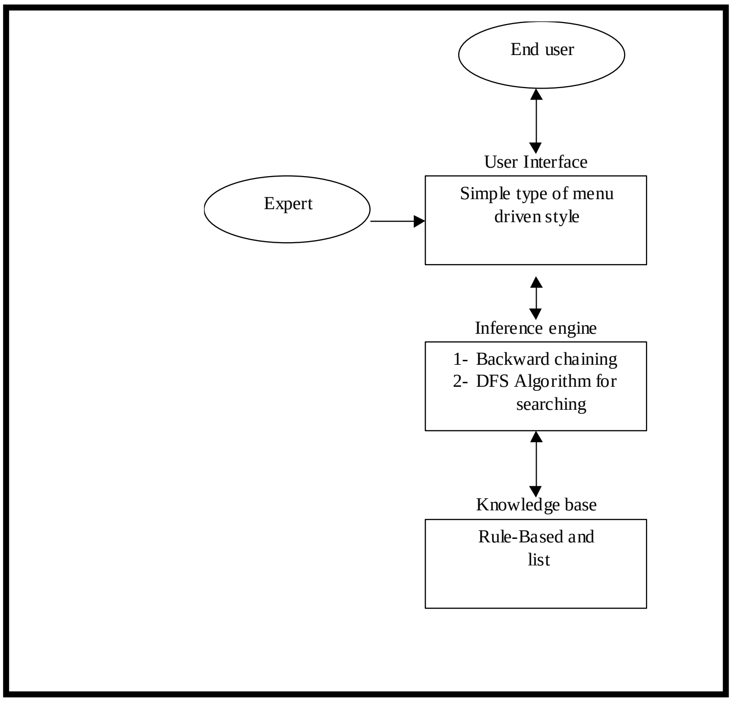


Fig. (5) Architecture of the Proposed System.

User Interface.

The user can interact with the system through an easy friendly interface, which uses a simple form of questions & answers technique.

The user interface of the system is menu driven with window style. The main window is illustrated in fig. (6) that display four categories.

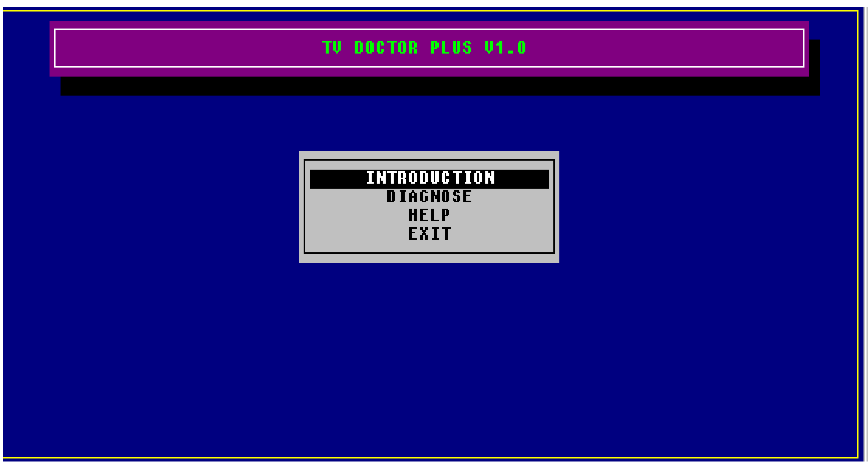


Fig. (6) Main Window in The proposed System.

The responsible rule of this menu is:
Interface:- make window (1,30,30,” “,0,0,25,80),
make window (2,0,0,” “,2,6,3,70),
make window (3,95,95,” “,1,5,3,70),
field-str(0,24,19,”TV doctor plus v1.0”),
field_attr(0,24,19,90),
menu(28,8,112,112,15,0,x,[“INTERODUCTION”,
DIAGNOSIS”,
“HELP”
“EXIT”]
X<>3,1,exccute(X).
If X=3 exit procedure is running.
If X=2 help procedure is running.

This is an importance facility since it service the user with the information needed about how the system is running.

The responsible rule of this procedure is: -
execute(2):- make window(9,30,30,”HELP”,0,0,25,80),
File_str(“raadproj\\raadhelp”,s),display(s),
Interface.

If X=1 diagnosis procedure is running.

The above procedure represent the heart of the system and is working using method (choosing-and-pressing).Fig. (7) show the architecture of the procedure.

a-User Interface

The responsible rule is (interface1).

b-Inference engine

From user input we conclude the solution. The responsible rule is (run(integer, integer)).

c-Display.

Show the result.

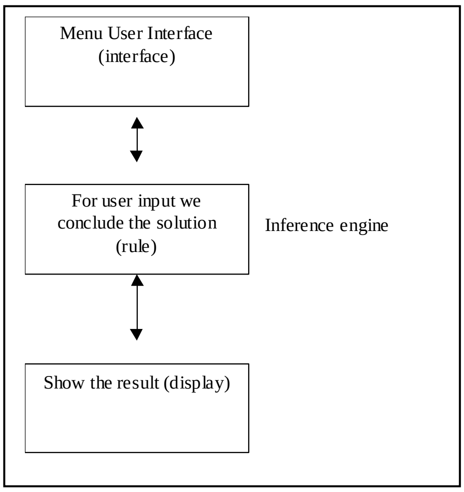


Fig.(7) Architecture of Diagnosis Procedure.

The main rule of this procedure is: -
excute(1):-!,interface1.
Interface:-makewindow(4,0,0,””,20,6,4,40),

makewindow(5,30,95,"ECS TO RETURN TO MAIN
MENU ",20,6,4,40),
makewindow(6,30,0,"",5,1,14,78),
shiftwindow(_),
field_str(1,8,5," A-1"),
field_str(1,8,5," A-2"),
field_str(1,8,5," b-1"),
…………………………
…………………………
msg(1,8,S), shiftwindow(_),move(1,8).
Msg(1,8,"No Light"):-!.
Msg(2,8,"Insufficient Light"):-!.
Msg(2,8,"No or Weak Sound"):-!.
…………………………………
…………………………………
the message box (msg) show the semantic name of the television faults.

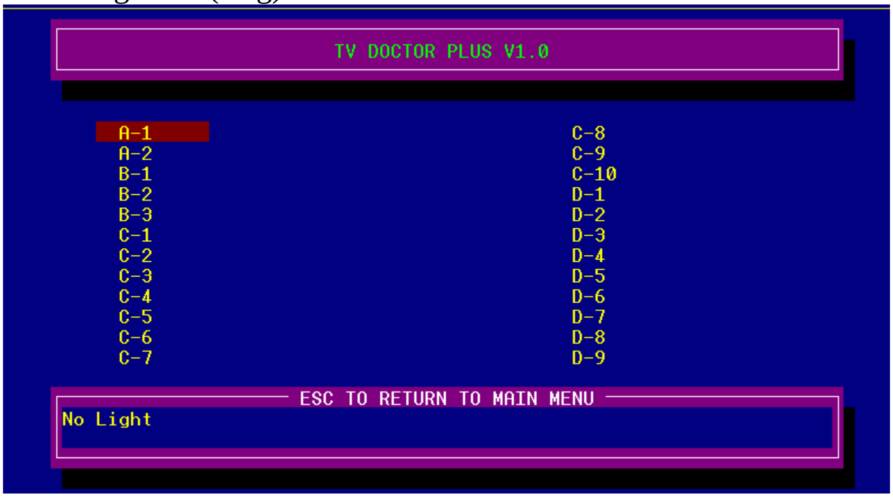


Fig. (8) Simple Window of Diagnosis Procedure.

Look now at the high-level rules that describe what evidence will define some faults, all of the arguments in each of the rules in this system belong to the symbol domain, so we are not showing the predicate or domain declarations.

The high-level rules in the procedure will have two parts. The first part is to simply look, the answer might be found directly; like rule1. The second part is to ask the user, and record his answer, and continue to ask until it has reached a conclusion

Rule1:

run(integer,integer):-!, makewindow(20,112,143,"The fault is left and right vertical",6,10,4,60),

disply("check circuit between 3505 , 2505).

Removewindo(_,_).

As shown in fig.(4.5b).

Rule2:

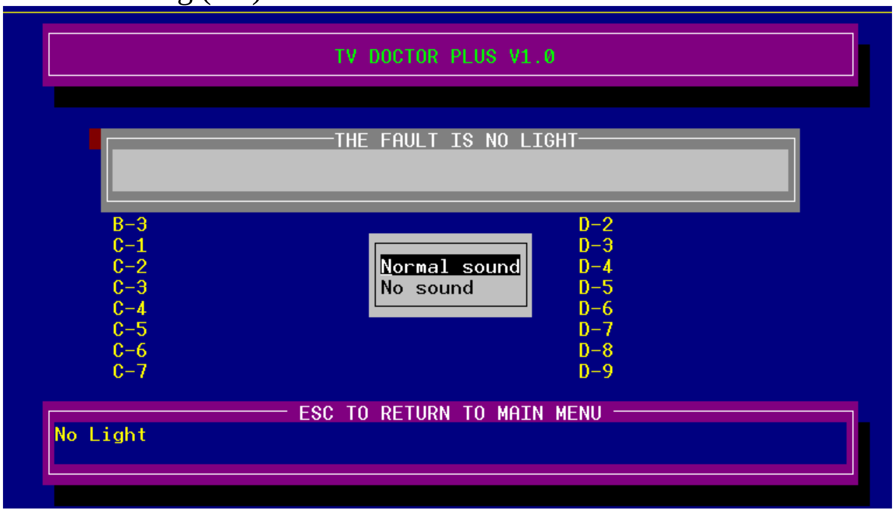
run(integer,integer):- makewindow(20,112,143,"The fault is No or weak sound",6,10,4,60),

menu(27.11.112.15,0,X,["No or Weak picture","Correct Black/White picture"]),

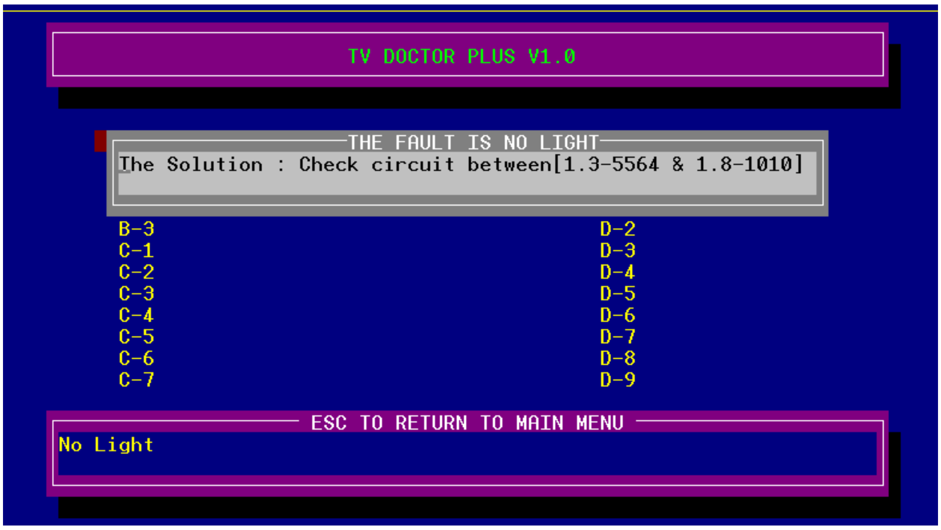
run3(X),

removewindo(_,_).

As shown in fig.(9-a).



(a)



(b)

Fig.(9 a&b) Diagnosis Procedure Screen.

The menu relation does much work. This is used to check specific attributes of the errors that may be have been discovered during the interfacing and that may have been written in to the database.

If X=0 introduction procedure is running.

This procedure displays some common information about system Stored in database.

The response rule of this procedure is:

execute(0):- make window(9,30,30,"INTRODUCTION",
0,0,25,80),
filed_str("raad proj\\radd.int",s),display(s),
interface.

9- Conclusions.

Several concluding remarks have been drawn from the process of designing expert system. The main ones are stated below:-

1- from all KB representation, we have found that rule-based systems are more suitable for diagnosis domain because it is compatible with human thing.

2- Although the diagnosis system use forward chaining as a control strategy, we found that using backward chaining would be more cost effective and increases the performance of the system since the domain goals are known and relatively few in member.
3- Using a simple menu-driven from us an interface with the user makes the system more acceptable and more friendly.
4- We have found that using the DFS as a search strategy in more appropriate to our system, since in the DFS, details are pursued as deeply as possible until the search fails, where us in DFS for example, all the possible premises at one level are scanned before moving on to the next detail level which requires a greater demand on memory usage, because it carries so many parallel paths.
5- We use PROLOG language for building our system because that prolog is a practical and efficient implementation of many aspects of intelligent program executing, such as non-determinism, parallelism and pattern directed procedure calls PROLOG also provides a uniform data structure, called term, out of which all data, as well as prolog programs, are constructor.

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