

An Expert System Optimization Model for Desktop Computers



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ABSTRACT

This study is about the collection of knowledge from experts in the field of computer diagnostics and storing it into an accessible database where it is available for others to use. The availability of expertise in diagnostics is needed by the non-experts.

The program serves as a guide tool for computer shop owners to give them the capability to repair defective computers without having the physical presence of a technician by using the stored knowledge in the database and following the step-by-step procedures.

Key words: Desktop Computer, Expert System, GUI, Weight Algorithm.

1. INTRODUCTION

Knowledge-based systems collect the small fragments of human know-how into a knowledge-base which is used to reason through a problem, using the knowledge that is appropriate [1]. What an actual expert system does is to provide knowledge that came straight from actual expert giving an expert's opinion to the user [2]. In this study, the expert system is implemented on desktop computers that are used in computer shops. It is an updateable knowledge database that makes use of human intelligence in the field of computer diagnostics [3,4]. Access to the program will be through the internet to provide ease of access for users in the computer shop business.

There are 3 factors that greatly affect the computer shop business: downtime, availability of the technician and costs. A defective computer reduces the income of the computer shop due to expenses in repairs and loss of potential customers for that particular unit, especially in peak business hours.

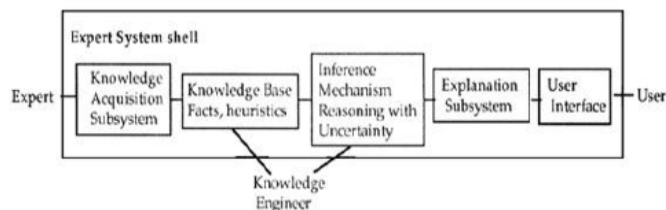


Figure 1: The Basic Components of the Expert System

Figure 1 shows the knowledge from the expert is stored into the knowledge base after acquiring the information. The information goes thru a subsystem which translates the information for the user to understand and is then displayed in the user interface.

The main objective of this study is to create an expert system by creating an algorithm using software that will specialize in desktop computer hardware and driver diagnostics to be implemented on six different computer shops. The study would be limited only to hardware and drivers meaning that the program would diagnose the physical element of the computer and the program that accompanies it in order to perform correctly.

An updateable knowledge database where the users can store information from experts is the key element of the program, making the information readily available [6, 7]. The users need not wait for the information to arrive because the data will be stored in a database located on the site for accessibility [8, 9,10]. The program simulates the judgment and behavior of a technician and intelligently seeks out the root of the problem much like an expert would [11, 12]. With the knowledge stored on the program, the users can easily address the problem and can diagnose it themselves which saves time and money [13, 14,15].

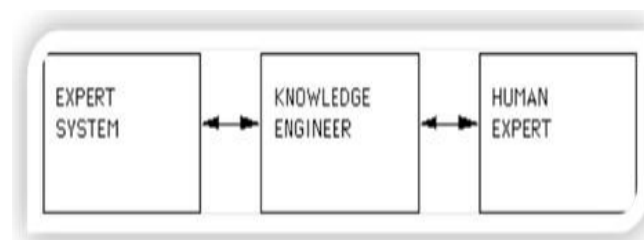


Figure 2: The Knowledge Acquisition Process

The primary goal of the expert system research is to make the expertise available for decision-makers and technicians who need answers quickly. There is never enough expertise to go around but it's not always available at the right place and the right time [16,17].

2. KNOWLEDGE-BASED EXPERT SYSTEMS

Knowledge-based expert systems, or simply expert systems, use human knowledge to solve problems that normally would require human intelligence. They are usually stored in a database [18]. Books and manuals contain a tremendous amount of knowledge but a human has to read and interpret the knowledge for it to be used. Conventional computer programs perform tasks using conventional decision-making logic, containing little knowledge other than the basic algorithm for solving that specific problem and the necessary boundary conditions. [19, 20]. This program knowledge is often embedded as part of the programming code so that as the knowledge changes, the program has to be changed and then rebuilt. Knowledge-based systems collect the small fragments of human know-how into a knowledge-base which is used to reason through a problem, using the knowledge that is appropriate. Spatial process algorithm can be used to improve the system [21].

Such systems are used for prospecting medical diagnosis or as educational aids [22]. They are also used in engineering and manufacture in the control of robots where they inter-relate with vision systems. For improvement of the system, the Neural network algorithm can be used [23,24].

The primary goal of expert systems research is to make expertise available for decision-makers and technicians who need answers quickly [25]. There is never enough expertise to go around -- certainly, it is not always available at the right place and the right time. Portable with computers loaded with in-depth knowledge of specific subjects can bring decade's worth of knowledge to a problem [26].

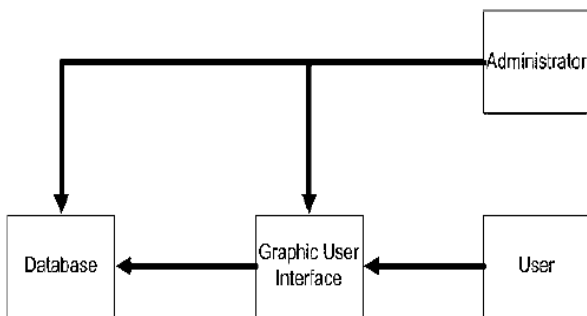


Figure 3: User's Access to the Expert System

An expert system is a computer program that simulates the judgment and behavior of a human or an organization that has expert knowledge and experience in a particular field. Typically, such a system contains a knowledge base containing accumulated experience and a set of rules for applying the knowledge base to each particular situation that is described to the program.

An expert system may be viewed as a computer simulation of a human expert. Expert systems are an emerging technology with many areas for potential applications.

Expert systems are typically very domain specific. For example, a diagnostic expert system for troubleshooting computers must actually perform all the necessary data manipulation as a human expert would.

The resulting system is modular in terms of software modules. The expert system is preserved as a stand-alone module (though its rule base has been somewhat extended to identify communication domain knowledge), as is the text planner.

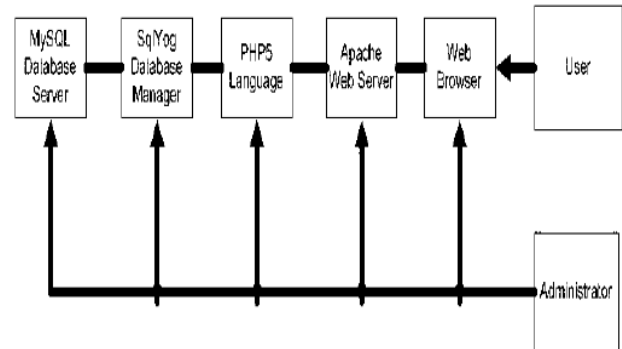


Figure 4: Software Flowchart

Figure 4 shows the interconnectivity of the programs and how the information is passed through. The MySQL database is the prime storage of the data for the program and the web browser serves as the GUI. The user can only access the program through the web browser while the administrator can access each program that is connected to the expert system. To improve the Expert System the Rough Set Theory can be used to handle incomplete information [27, 28].

PHP primarily acts like a filter taking input from a file or stream containing text [29]. The principal focus of PHP is server-side scripting PHP is a language script used by computers. PHP was originally designed for producing dynamic web pages and eventually evolved to the point that it could include a command line interface capability and can be used in standalone graphical applications.

PHP is a widely used general-purpose scripting language that is well suited for web development and can be implemented into HTML. PHP generally runs on a web server. Taking PHP code as its input and creating web pages as output. It is also used for command-line scripting and client-side GUI applications. One of the pros of a PHP is that it can be deployed on most web servers and many operating systems and platform.

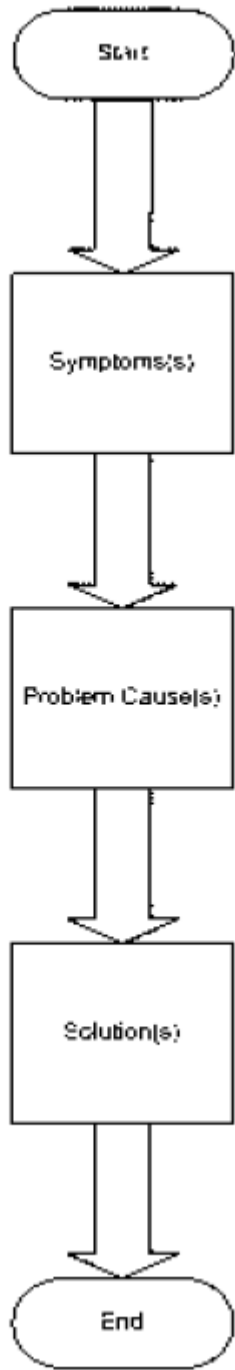


Figure 5: User's Point of View

Figure 5 shows the basic flow of the program and how the information is sent to the user. All of the data comes from the database and is now loaded to the GUI which interacts with the user.

Neuroscience is the study of the nervous system, particularly the brain. It is the foundation of Neural networks. The exact way in which the brain enables thought is one of the great mysteries of science. It has been appreciated for thousands of years that the brain is somehow involved in thought [30,31].

Computer chips can execute an instruction in a nanosecond, whereas neurons are millions of times slower. Brains more than makeup for this, however, because all the neurons and synapses are active simultaneously, whereas most current computers have only one or at most a few CPUs. Thus, even though a computer is a million times faster in raw switching speed, the brain ends up being 100,000 times faster at what it does.

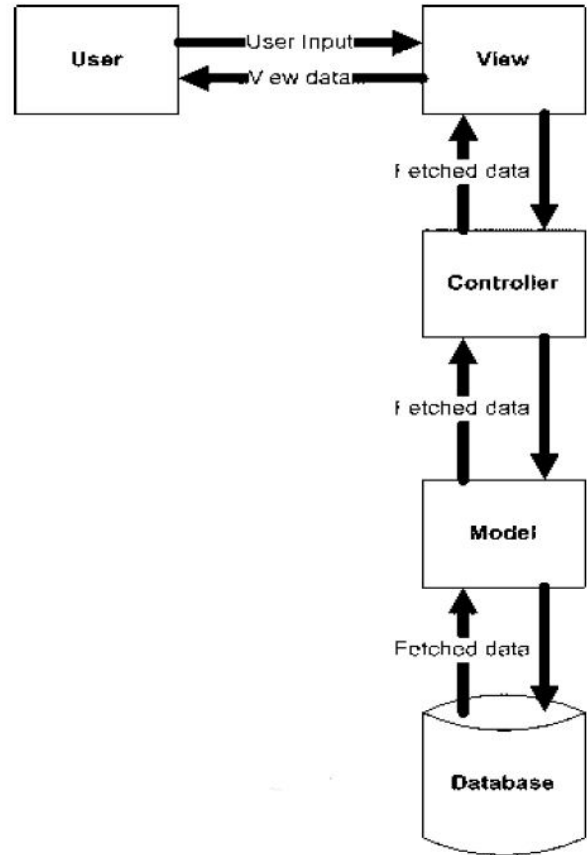


Figure 6: MVC Framework

Figure 6 shows how the information is fetched from the database of the program. The path of the data works both ways in receiving and retrieving information from the stored knowledge in the database.

Decision tree induction is one of the simplest, and yet most successful forms of the learning algorithm. It serves as a good introduction to the area of inductive learning and is easy to implement. A decision tree takes as input an object or situation described by a set of attributes and returns a “decision” – the predicted output value for the input. The input attributes can be discrete or continuous; learning a discrete-valued function is called classification learning; learning a continuous function is called regression.

The idea of an ensemble learning method is to select a whole collection, or ensemble, of hypotheses from the hypothesis space and combine their predictions. Another way to think

about the ensemble idea is as a generic way of enlarging the hypothesis space. That is, think of the ensemble itself as a hypothesis and the new hypothesis space as the set of all possible ensembles constructible from hypothesis in the original space.

An assembler language is a symbolic language that is similar to a machine language. It can also be called a machine-oriented or low-level programming language.

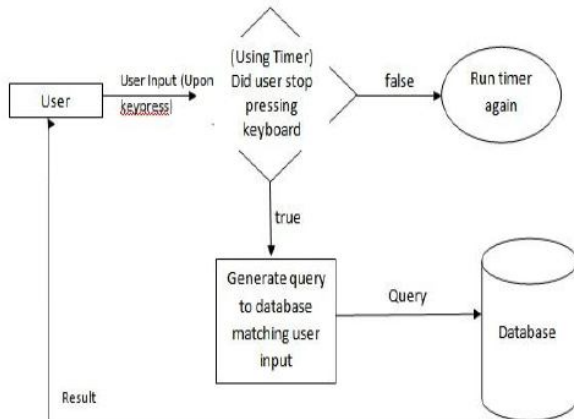


Figure 7: Block Diagram of the GUI (Auto-complete)

Figure 7 shows the block diagram shows the process of the auto-complete function in the program. The words typed on the input box is timed for a certain period which then searches the whole database for the currently typed letters or words. The timer resets every time a character is typed on the input box.

Neurocomputing is a technological field that deals with information processing systems that autonomously develop operational capabilities on adaptive response to an information environment.

Expert systems are artificial intelligence programs that incorporate a knowledge base and an inferencing system. This system is a highly specialized piece of software that attempts to duplicate the function of an expert in some field of expertise. It can act as an advisor in its domain of interest by capturing the knowledge of experts in that field and thus, non-experts can then use the expert system to solve problems, answer questions and make decisions in the domain.

3. THE ALGORITHM

The Recommendation Algorithm is how the program finds related symptoms aside from the symptom typed by the user in the input box of the program. It is an added feature which helps the user look for symptoms of a defective computer. For the weighting algorithm, the Logic Scoring of Preference can be used [32, 33].

Get symptomid of inputted symptom:

Symptom 1 = id(1) in symptoms table(in database)

Get siblings (symptoms with similar problem cause) from questioncause table(in database):

Symptom 1 => Problem cause 1

Problem cause 1 => Symptom 1, Symptom 2, Symptom 3, Symptom 4

Get (and collect) Symptom 2, Symptom 3, Symptom 4

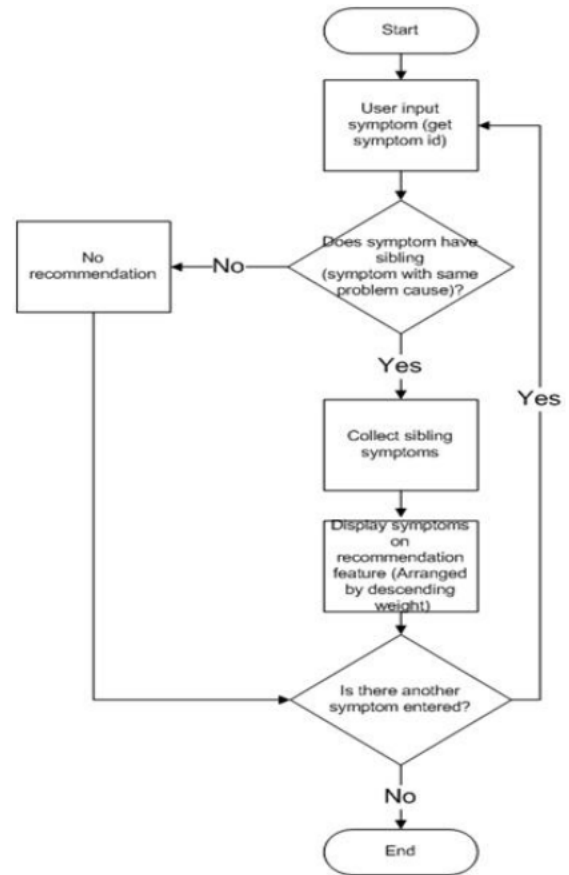


Figure 8: Recommendation Function Flowchart

Figure 8 shows the recommendation function is an added feature of the expert system. It finds other related symptoms to the symptom(s) that the user selected in the input box of the program. It shows the symptoms that may be connected to the current problem of the user.

Display recommended symptom(s) arranged by descending weight:

Symptom 2 = 4(weight)

Symptom 3 = 5(weight)

Symptom 4 = 2(weight)

Recommendation (Display):

Symptom 3

Symptom 2

Symptom 4

The Weight Algorithm is the key algorithm of the whole program for it decides which symptoms, problem-causes, and solutions to display. It is a filtering system that separates the information not related to the user's query. It also arranges the results in order of severity related to the symptom(s) selected. This data can be placed in a database like in [34, 35].

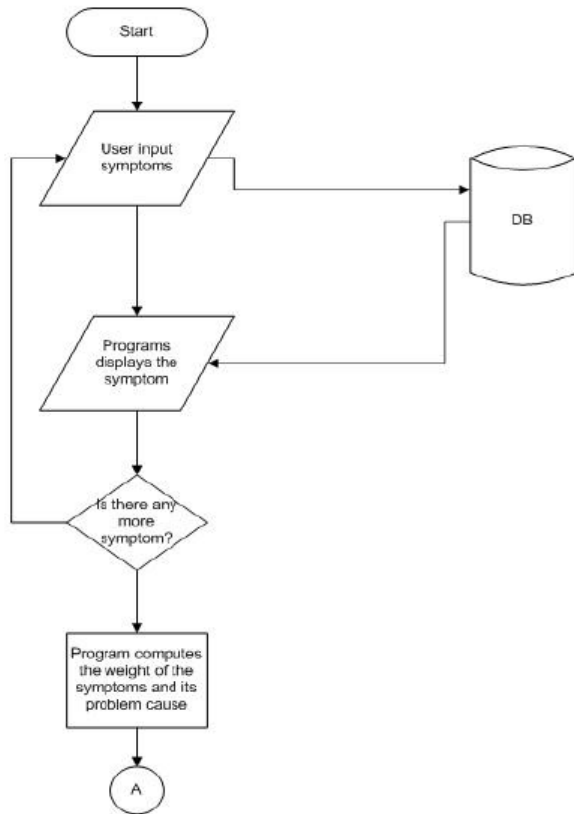


Figure 9: Program Flowchart

Figure 9 shows the main flow of the entire program and shows how the program gathers the needed information from the database based on the symptom(s) typed in the input box.

Weight Logic Formula

Group all symptoms with the same problem cause parent

Symptoms 1,2,3 = Problem cause 1

Symptoms 4,5,6 = Problem cause 2

The system will now sum up the weight of all symptoms

Symptom 1 = weight of 5

Symptom 2 = weight of 3

Symptom 3 = weight of 1

Symptom 4 = weight of 3

Symptom 5 = weight of 2

Symptom 6 = weight of 1

Problem cause 1 = Symptom 1 + Symptom 2 + Symptom 3 = 9

Problem cause 2 = Symptom 4 + Symptom 5 + Symptom 6 = 6

Arrange all gathered Problem Cause, based on sum of the listed symptoms related to it, in descending order (from higher to lower)

- (1) Problem cause 1
- (2) Problem cause 2

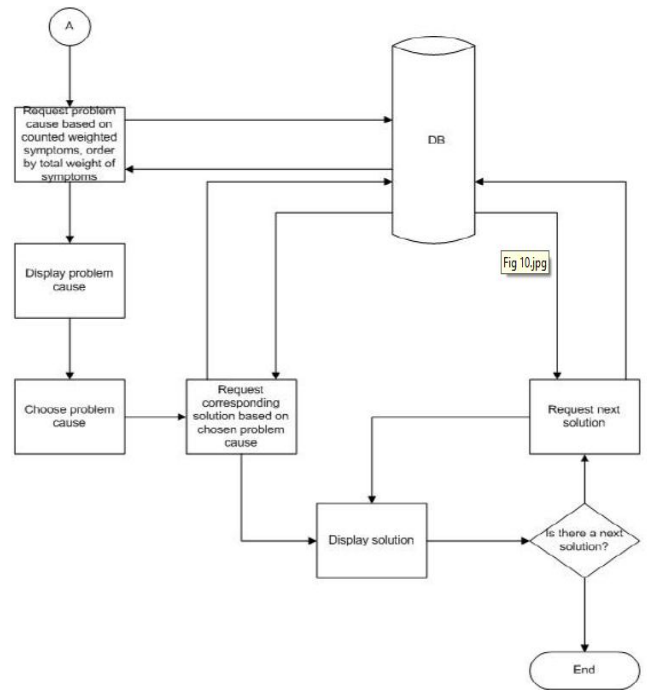


Figure 10: Program Flowchart continuation

4. CONCLUSION

Most people do not know what to do when their computer breaks down, some resort to having a technician fix it or just buy a new one. Both of which costs valuable time and money for computer shop owners. This computer program helps experts and non-expert diagnose computers from common computer problems to a more sophisticated one which make their life easier by making the information from experts readily available. The results of the research show that the major advantage of the program is its immediate availability which is beneficial to experts and non-experts alike. The expert system decreases the downtime of a computer in a computer shop by having the available people tend to the defective computer. If an expert uses the program, they can quickly identify the cause of the problem thus increasing their productivity and effectiveness.

The expert system does not threaten the livelihood of computer technicians and does not intend to replace them but rather it serves as a tool for them to use in diagnosing computer problems. For non-experts, the expert system serves as a guide for them to try to troubleshoot defective computers on the event that a technician isn't available or has yet to arrive.

The researchers recommend that if ever, in the near future, developers who are going to use this kind of program make sure that they keep on updating their databases. Some symptoms might quickly get obsolete due to the fast

progression of technology today. It is also recommended to improve the GUI to make it more appealing to other people. It would also be very useful if this program can be made into a mobile phone application making it even more accessible that it can be used even when there is a power outage. It is also recommended to widen the scope of the program making it able to diagnose software programs and teach how to improve the computer's performance. The most important part for researchers interested in this field of study is to rely on the feedback of the target population for they control the shape and the overall design of the program.

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