

Expert system for the diagnosis of toxicological emergencies**Sistema experto para el diagnóstico de emergencias toxicológicas**

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Abstract

The population growth far exceeds the increase in the number of hospitals and health centers, further, the number of physicians considered experts in their specialty area are not sufficient to meet the growing demand of the population. Expert systems have a very important area of application in the medical field, in addition to social and economic impact. This paper presents the analysis, design and implementation of the project "Diagnostic Expert System for toxicological emergencies". Conceptual and theoretical foundations used for its creation are described, information modules creating user interface, expert interface and inference engine which operate in accordance with the provisions outlined.

Resumen

El crecimiento de la población supera con creces el aumento del número de hospitales y centros de salud, además, el número de médicos considerados expertos en su área de especialidad no es suficiente para satisfacer la creciente demanda de la población. Los sistemas expertos tienen un área de aplicación muy importante en el ámbito médico, además de tener un impacto social y económico. El presente trabajo muestra el análisis, diseño e implementación del proyecto "Sistema experto para el diagnóstico de emergencias toxicológicas". Se describen los fundamentos conceptuales y teóricos utilizados para su creación, se detalla la información de los módulos de creación de la interfaz de usuario, la interfaz de experto y el motor de inferencia que funcionan de acuerdo a lo establecido.

Formerpert system, Toxicological emergencies

Sistema experto, Urgencias toxicológicas

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Introduction

Due to the accelerated industrial and technological development of today's world, our environment presents us with new risks that we must face more frequently. In recent decades, the increase, availability and use of potentially toxic chemical substances in industries, as well as their improper handling, lack of protection elements and in some cases carelessness or suicidal and criminal actions, among other things, have generated medical emergencies of the toxicological type which arrive every day at the emergency services of hospital entities in the region. Given this perspective, the need arises to develop a computational tool that provides support to the general practitioner in an area of toxicological emergencies.

Goals

The main objective of the "Expert System for the Diagnosis of Toxicological Emergencies" is to provide decision-making support to doctors in the emergency area when establishing a diagnosis and treatment, and thus reduce the time of action and care of a patient. In an emergency, reduce the secondary effects that the patient may present, in addition to a large reduction in costs in medical services. On the other hand, the generation of this system facilitates access to information, which is only achieved at this time by consulting a specialist in toxicology.

The system consta from the following main elements for its operation:

- Inference engine.
- Babe of knowledge.
- BaI know facts.
- B.search for symptoms.
- B.search by emergency.
- Iexpert interface
- Iuser interface

Mconceptual map of the modules

LInformation on the symptoms of the most common toxicological emergencies that afflict patients presenting in the emergency area is stored in the knowledge base through an expert interface which is designed to capture all knowledge from an expert in the area, queries are made through a user interface to capture the facts.

The inference engine is programmed to identify the type of emergency according to the symptoms presented by the patient, the system uses deduction methods and abduction in order to reliably present a set of possible diagnoses for what ails the patient based on the facts that have been captured. Each symptom of a conduct disorder is captured with a weight ranging from 10 to 100 according to its importance. The inference returns a possible diagnosis with a percentage of certainty. (Fig.1)

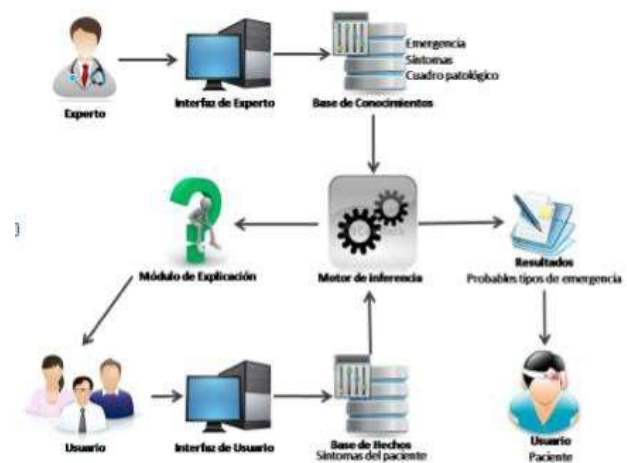


Figure 1 Conceptual map of the modules

System design

The following figure describes the operation of the system. The central block represents the generating system for the diagnosis of Toxicological Emergencies and the two upper branches represent the knowledge and processes with their respective modules, the lower block represents the tests applied with the most important types of intoxication. (Fig.2)



Figure 2 Concept map of the project

Interaction with the database

Figure 3 shows the order of the elements and their use in the system database.

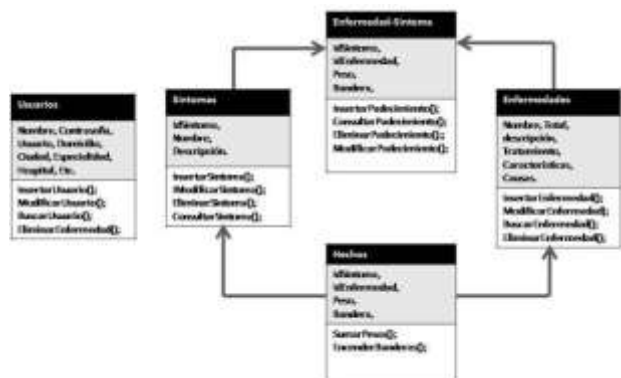


Figure 3 B.data base

Users: It is the table in charge of saving the information of the users of the system, its methods are: Search, eliminate, modify and insert users within the database.

Symptoms: Table that contains information on the symptoms used in the system, which interacts with the Diseases table.

Facts and DiseaseSymptom: These two tables are built in the same way, since one is a backup of the other, it has the same methods as the previous ones, but this one also has a method that allows you to turn on Y toto pay flags for andl operation of the inference engine. **Diseases:** This table contains all the information Referrer to the conditions registered in the system, its methods are to insert, andliminal, Modify Y andeliminate ailments.

System interface

The Expert System consists of 4 levels

In the first level is the INDEX that welcomes the system which gives the option to log in with a valid user or register a new user in the system, from this welcome page 4 second level elements emerge, which correspond at 3 of the main actions of the system (Consultation, Diseases and Expert) and the informative page "About". On the third level are the Consultation pages through search by symptom, Disease information, and the expert interface for user and disease management, as well as the modifications that the expert can make within the system with a validation, for example.

Lastly, the 4th level is in charge of handling the inferences in the query to be able to return results, and execute the actions in the database, such as registering new diseases and managing users that are Expert actions. (Fig.4)



Figure 4 System modules

Results

Figure 5 shows the initial cover of the project, it contains the name of the project and the access tabs to other sections. It consists of two main options:

- Inlogin for already registered users
- Registration for new users.



Figure 5 Access to the system

When starting a session with a valid registered user, the system immediately sends us to the query area, in this area you can select some symptoms to start with the sequence of steps to reach a diagnosis, as shown in figure 6.



Figure 6 Consudischarge due to symptoms

By selecting the symptoms and pressing the "Consult" button, the system directly consults the database and, according to the information obtained, performs the calculations to show a result, which is shown in percentages of probability that it is a problem. specific condition or another, as shown in Figure 7.



Figure 7 Results of consultation

Upon entering the "Results" page, you have two options to follow. The first is the option called —Results| (Fig. 8) that will show all the information on the condition with the highest percentage of probability (Fig. 9).



Figure 8 Bouncedn to access information about the condition



Figure 9 Information on the condition with the highest percentage

Another option is called "Questions" (Fig. 10), where questions regarding the consultation must be answered, the inference engine obtains a symptom not considered of the disease/suffering with the greatest probability of being the correct one and analyzes it based on to the symptoms presented by the patient (Fig. 11).

These questions stop when the percentage of any of the conditions analyzed reaches 100, at which time the system sends directly to the results area even when the "Questions" option has been selected.



Figure 10 Bobutton to access the question area



Figure 11 Area of questions

The Diseases page is the area for the description of the conditions, in which a list of the conditions that the system has stored in its knowledge base is obtained, through which it resolves the queries. By clicking on the "Consult" button, information about the condition is displayed, such as causes, treatment, as well as characteristic symptoms. (Fig.12)



Figure 12 Information on the disease consulted

In the expert section, the user who has the necessary permissions can make use of the two administration options: manage the information on Diseases or Users. (Fig.13).



Figure 13 Expert Area

Diseases: In the diseases section (Fig. 14), the expert will be able to register new diseases to join those already established for consultations.



Figure 14 List of diseases

If the symptom that presents the new disease is not in the list that appears on the page, a new symptom can be registered in the symptom section found at the end of the registration page for a new disease. (Fig.15)



Figure 15 List of symptom

Users: In the users section (Fig. 16), only the system administrator can manipulate user permissions.



Figure 16 User Management

The Expert area has two main functions: granting permissions to users so that they can enter new information in the Expert-Diseases area. (Fig.17)



Figure 17 Withgive permissions to users

Conclusions

This article presents the results of an Expert System used to identify behavioral disorders and diagnose behavioral disorders through knowledge-based systems, the general objective of the proposed project is fulfilled satisfactorily since it helps to detect behavioral disorders, evaluate them correctly, and propose therapeutic objectives and strategies for families and teachers.

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