Implementation of an Intelligent System for the Diagnosis and Treatment of Venereal Diseases

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Abstract—Over time, human beings are attacked by different venereal diseases, which cause serious consequences. Not all people know exactly if they suffer from a venereal disease, so they look for possible treatments based on their symptoms in different media, not all of them are reliable. The objective of the research is to implement an expert system that, through a web page, provides a correct diagnosis based on the symptoms registered by the user, as well as a possible treatment for the identified disease. This was achieved based on the knowledge tree that was developed in Python so that when a user records their symptoms, the expert system validates the process. All this procedure was carried out using the Commonkads methodology. which is related based on knowledge topics. The result was the development of the application, which was validated by different specialists in expert systems, as well as by different users, giving a total average of 4 as a response, which was qualified as a high-quality level, on the other hand, the system brings an improvement in the acquisition of information through the web, providing diagnoses and possible treatments, in addition, it provides a facility to people who do not wish to attend a health establishment, as well as to specialists in the health sector, which allows them to provide diagnoses and treatments.

Keywords—Commonkads, diagnosis, venereal diseases, expert web system, treatment

1 Introduction

Over the years, a large number of people become infected with any venereal disease, these infections are increasing considerably, to the point of being part of the daily life of human beings.

Internationally there are multiple cases of infection with sexually transmitted diseases (STD). In different areas located in Asia, South America, Africa, and the southeastern United States, mention is made of lymphogranuloma venereum infection, which is associated with HIV, achieving an infection that is increasing [1]. On the other hand, the most frequent venereal infections in the US are chlamydia and gonorrhea, they present multiple cases of contagion, which to date remains in force [2]. In addition, in

various developing countries, an estimated 70% of people suffer from venereal infections that affect the skin, either due to various factors, such as the environment, or sexual relations, among others [3].

Sexually transmitted diseases increase their cases annually in the world. In Peru, millions of people are already infected with these diseases and usually live with this virus daily, on the other hand, there is also a group that does not carry the infection, but they tend to get infected by having sexual contact with other people or also by other causes; women of various ages, are diagnosed with Chlamydia or also with vaginal trichomoniasis [4]. These diseases are common in women, however, on the part of men, the most common disease is acquired immunodeficiency syndrome (AIDS) or immunodeficiency virus human (HIV).

The sectors of Lima and Callao have a high rate of contagion of venereal diseases, in which the infection that stands out the most is HIV. A group of 51% of people was diagnosed with HIV, in which young people aged 20 and over and adults over 34 years stood out [5]. In Lima and Callao, 58% of STD cases were registered throughout Peru [5]. On the other hand, in the year 2021, it was estimated that the victims are men in 74% of HIV cases [6]. In addition, young adolescents from Lima and Callao who are approximately 15 to 29 years old, know about the prevention of sexual diseases but reject these concepts for having erroneous ideas [7]. On the other hand, in Lima and Callao, some men have intercourse with individuals of the same gender and transgender people [8]. The relationships of people of the same gender have a great risk of acquiring venereal diseases; it is estimated between 18% and 22% of the general population become infected [9].

The importance of this research is to implement a system that provides a diagnosis of venereal diseases, to contribute to the health sector, as well as to the people who will benefit from this activity. Since Lima Callao has a high rate of STD infections at a national level, they are not usually informed correctly, nor do they usually have a correct diagnosis.

The main objective is the creation and implementation of a system through a web page with true information for a diagnosis, this would be achieved by affiliating varied and specific information from medical specialists, in addition, to relating the symptoms suffered by the patient, and thus would obtain correct information, as well as its correct diagnosis and treatment. This achieves a better interaction of the user with the system, allowing the fulfillment of one of the branches of artificial intelligence [10], which contributes a lot to the project, so when a patient registers his symptom, the web system will show the diagnosis with the most matches. On the other hand, it also aims to benefit the person himself, because in some cases, he does not have the availability to attend a health center, and with this expert web system, he will have a place where he can obtain a correct diagnosis related to venereal diseases and that it is also reliable and, on the other hand, it is very beneficial for the network of hospitals, because they will have a greater number of insured patients.

This work is structured as follows: Section 2 discusses the review of the literature, section 3, the methodology, where the steps to be carried out are indicated; Section 4 the results and discussions; finally, Section 5 the conclusion and future work.

2 Literature review

The research allows a global visualization of the scope of the different information technologies or also known by the acronym "IT" in the health area, in recent years there has been an increase in the rate of infections of venereal diseases, as well as for young people and adults, with young people having a higher rate of infections. Through multiple investigations, various authors propose different expert systems, in order to provide information, detection, and possible treatment of venereal disease, these systems were developed with multiple methods, either through algorithms based on knowledge of any other machine learning method.

Caliwag et al. [11] report that STDs are transmitted to both men and women through sexual contact, in addition, they highlight that the United States has a large percentage of infections, generating millions of infections in the course of a year. Due to this, they implemented a mobile expert system capable of providing information about sexually transmitted diseases, in addition, the system has the ability to provide a diagnosis based on the various manifestations of the symptoms that a patient may present, and the application is carried out by means of the fuzzy logic algorithm and the decision tree algorithm, in addition to having as support the compilation of several studies and bibliographical research with interviews with experts in venereology. As a result, they obtained approval for the functionality and efficiency of the mobile application, the application met the objectives established through the results of the surveys that were given to experts and patients with sexually transmitted diseases.

On the other hand, Saree et al. [12] comment on an STD that stands out among people of both genders, which is known as herpes zoster, which attacks the skin, causing mild or severe consequences to the person who suffers from it. For this reason, they implemented an expert system capable of diagnosing herpes zoster, for this, they applied the Forward Chaining search model, which is applied to carry out the search for symptoms of a disease, in addition, they developed Bayes's theorem, the which allowed them to calculate with certainty the degree of diagnosis, calculating the probability of each of the symptoms. As a result, they obtained a system that has knowledge related to a doctor's diagnosis in order to detect venereal diseases. Concluding that the results generated by the system were reinforced by the calculation of Bayes's theorem.

On the other hand, Revell et al. [13] They tell us about another venereal disease, which is called HIV, this disease is constantly advancing, which is why it is usually a constant challenge for medical specialists who have few resources, causing their decision-making about treatments to be even more complex. For this reason, they implemented an expert system that provides diagnoses and a selection of treatments online, which was developed based on other methods, called a random forest model, which consists of a collection of decision trees, this forest is responsible for giving a prediction of how likely the viral load is. As a result, the different models achieved a consistent validation, due to their high level of precision when giving predictions about treatments related to venereal disease. Likewise, Sloot et al. [14] speak of another expert system in relation to HIV, in which they applied another method, based on integration in GRID computing and access to different databases related to patient symptoms, and muta-

tions, among others. Other data, in addition, they applied a rule-based fuzzy logic analysis, which provided a classification of patient-specific information, as a result, the problem-solving environment achieved a virus-sensitive prediction, which is generated from the comparison. of the viral genotype with the information from the database, concluding that the use of Grid technology and artificial intelligence can achieve the extraction of knowledge and at the same time can provide useful advice, either for treatment or any other action for prevention. prevention. Medical decision-making in the face of HIV. However, Adhi Pamungkas et al. [15] inform us about the implementation of another expert system in HIV guidance, whose purpose is to carry out the early detection of HIV, it was developed through direct chaining and the certainty factor, in addition to having the ESDLC methodology and its different phases, resulting in the approval of 50 users, who were given a questionnaire to evaluate the functionality of the system.

In conclusion, the authors propose technological solutions such as the implementation of an expert system or also known as an intelligent system, through different methodologies in reference to automated learning, resulting in a considerable improvement with respect to the detection of various venereal diseases to avoid your progress. However, in allusion to the aforementioned systems, it was possible to identify that their operation is based on solid knowledge, therefore, the implementation of more modules or an update of information on diseases could not be carried out, since, in some cases, the diseases are in constant progress and can develop new variants and the system would not be prepared. That is why the present research work will allow the implementation of an expert system that is constantly updated in relation to the information for a more precise diagnosis and treatment.

3 Methodology

This section mentions the steps to follow for the implementation of the expert system. In this case, the Common KADS methodology was used, since it allows us to carry out a development based on knowledge. In addition, it provides facilities when identifying, capturing, and modeling knowledge to correctly couple it to the expert system [23]. On the other hand, on the software development side, tools such as Python were used for the programming environment language and SQL Server as the database storage manager. In addition, Balsamiq was also used to design the prototypes of the expert web system.

3.1 Methodology stages

For the implementation of the expert web system, the Common KADS methodology was applied. Which is a flexible approach to implementing knowledge-based systems through a set of models [16]. This methodology consists of 6 models, 5 dedicated to the analysis and one to implementation and development.

Model of the organization. It is considered a tool since analysis is carried out and the problems that the organization that will carry out the implementation of the System based on knowledge are described [17].

Task model. It is known as the highlights of the process; the assignments to be elaborated in the system are established and distributed to each agent for their work in the project [18].

Agent model. A person or software capable of executing assignments can be considered an agent; In this model, different characteristics of the agents are mentioned, such as restrictions and competencies [19].

Communications model. The information that is exchanged between the agents at the time of carrying out the tasks announced in the task model is collected in detail [19].

Knowledge model. It is the most important methodology, which gives it life since it forms the solution to the problems of an agent at the moment of carrying out an assignment. The knowledge model is also known as experience; This model differentiates knowledge modeling of the system from problem-solving [20].

Design model. Compared to the 5 models mentioned, which highlight an analysis of the system based on knowledge, this last model applies the descriptive review of the architecture and model of the system design before being elaborated. At this point, the software functionality, and the platform, among other details that will be useful for the implementation, are developed [21].

Likewise, the points mentioned above are displayed in Figure 1, in which the models of the Common KADS methodology are established, as well as the relationship they establish.

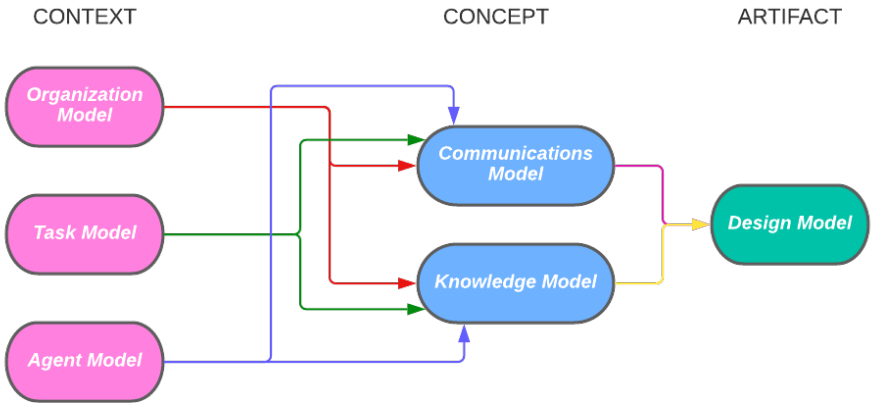

Fig. 1. Common KADS related models

3.2 Development of the methodology

Contextual model

Task model. This section describes the activities carried out by the agents within the organization in order to obtain an analysis of the identified tasks and their relationships

between them, where the intelligent system will be implemented. As shown in Table 1, the conditions and resources to carry out the implementation are detailed.

Table 1. Task analysis

Modelo de Tareas	Documento de análisis de tareas
Task	Evaluate the symptoms and ailments of the user that allows an accurate diagnosis of venereal diseases.
Objective and Value	The objective is to identify the symptoms suffered by the user according to the selection of alternatives in the system to make a more accurate diagnosis.
Dependencies and Flows	This point will allow the development of the implementation of the expert system based on the knowledge of medical experts in the field.
Manipulated objects	Inputs: personal data of the user and symptoms suffered by the user.
	Outputs: Structure of the identification of venereal diseases.
Agents	Carried out by the different users who need to rule out venereal diseases.
Knowledge and capacity	The stored knowledge of experts in the field and reliable information from external sources are used.
Quality and efficiency	The task was performed in a secure, detailed, and private manner.

Agent model. In this model, mention is made of the people who perform the tasks to carry out the communication between the task model, the knowledge model and the communication model. As can be seen in Table 2, the limitations and capabilities of the agent in solving the task are modeled.

Table 2. Agent model

Agent Model	Agent Description Document
Name	Patient
Organization	Type: Human
Involved	Consultation of the user with his symptoms.
	Obtain identified disease of the user.
	Obtain possible treatment of identified venereal disease.
Communicates	Dermatologist
	Proctologist
	Gynecologist
	Urologist

Conceptual model

Communication model. This section represents the results of tasks executed by the agents, which serves as information supply for other agents. As detailed in Table 3, the exchange of information between the agent model and the task model can be identified, based on communication patterns and restrictions.

Table 3. Communication table

Communication model	Document on the communication model
Name	Make inquirí
Information	Symptom selection and intelligent system rules.
Involved	Expert agent - user
Restrictions	The user must register to the system and must select the symptoms that he/she suffers from.
Information exchange specification	The system verifies if the user has a medical history, in the same way, the user makes the selection of the symptoms that he suffers and sends it to the intelligent system for a quick response.

Knowledge model. This section is important for the expert system, since at this point the 3 main categories of the knowledge model are developed. As shown in Table 4, the elements that make up the knowledge model for the identification of venereal diseases are analyzed.

Table 4. Knowledge model

Knowledge Model	Document on the knowledge model
Knowledge Model	The knowledge-based system contains great information on symptoms that are caused by venereal diseases.
Knowledge sources used	For the elaboration of the expert system, the data provided by the medical experts in the field were used and they were collected from reliable sources on the Internet.
Validation results	By classifying the symptoms of venereal diseases, it was found that the system approaches an accurate result.
Knowledge acquisition material	The materials used for its implementation were articles on the internet.

Knowledge base. In this first section of the knowledge model, the elements made up of the symptoms of venereal diseases are presented. As detailed in Table 5, the relevant knowledge that allows the system's reasoning process to be carried out is identified.

Table 5. Symptom identificación

N.º	Description	Variable	Worth
1	Gender	GE	Male or female
2	Burning when urinating	AO	Yes, No
3	White, yellow, or green discharge from the male reproductive tract	SM	Yes, No
4	Swelling or pain in the genitals	IT	Yes, No
5	Increased vaginal discharge	SF	Yes, No
6	Bleeding outside of the period	FP	Yes, No
7	Appearance of sores	AL	Yes, No
8	Duration of sores	DL	3 weeks > and < 6 weeks
9	The reddish-brown or red color of the sores	CL	Yes, No
10	Feel fatigued	FT	Yes, No
11	Headaches	DC	Yes, No
12	Fever	FI	Yes, No
13	Bleeding from the rectum	SR	Yes, No
14	Pain when defecating	DD	Yes, No
15	Shaking chills	ES	Yes, No
16	Mouth ulcers	UB	Yes, No
17	Rash	SP	Yes, No

Rule base. In this second section of the knowledge model, the most accurate identification for the detection of a disease is defined, through the selection of symptoms by the user. As shown in Table 6, the inference structure of the system's knowledge is detailed, for a more precise deduction based on the symptoms.

Table 6. Inference rules

The rule for the detection of Gonorrhea - GN
If, (GE=Female) and (AO=Yes) and (SF=Yes) and (FP=Yes) then Gonorrhea is Detected. If, (GE=Male) and (AO=Yes) and (SM=Yes) and (FP=Yes) and (DD=Yes) and (SR=Yes) then Gonorrhea is Detected.
The rule for the detection of Syphilis - SL
Yes, (GE=Male) and (AL=Yes) and (DL>3weeks and DL<6weeks) and (CL=Yes) and (FT=Yes) and (DC=Yes) and (FI=Yes) and (IT =Yes) then Syphilis was Detected. If, (GE= Female) and (AL=Yes) and (DL>3weeks and DL<6weeks) and (CL=Yes) and (FT=Yes) and (DC=Yes) and (FI=Yes) then Syphilis is Detected.
The rule for the detection of Human Immunodeficiency Virus - HIV
If, (GE=Female) and (FT=Yes) and (FI=Yes) and (ES=Yes) and (UB=Yes) and (SP=Yes) then HIV is Detected. If, (GE=Male) and (FT=Yes) and (FI=Yes) and (ES=Yes) and (UB=Yes) and (SP=Yes) then HIV is Detected.

– Tree of knowledge: In this third and last section of the knowledge model, the rules of inference are represented, which are indicated by means of arrows, which are related to the symptoms to finally give us a more precise detection, as can be seen in Figure 2.

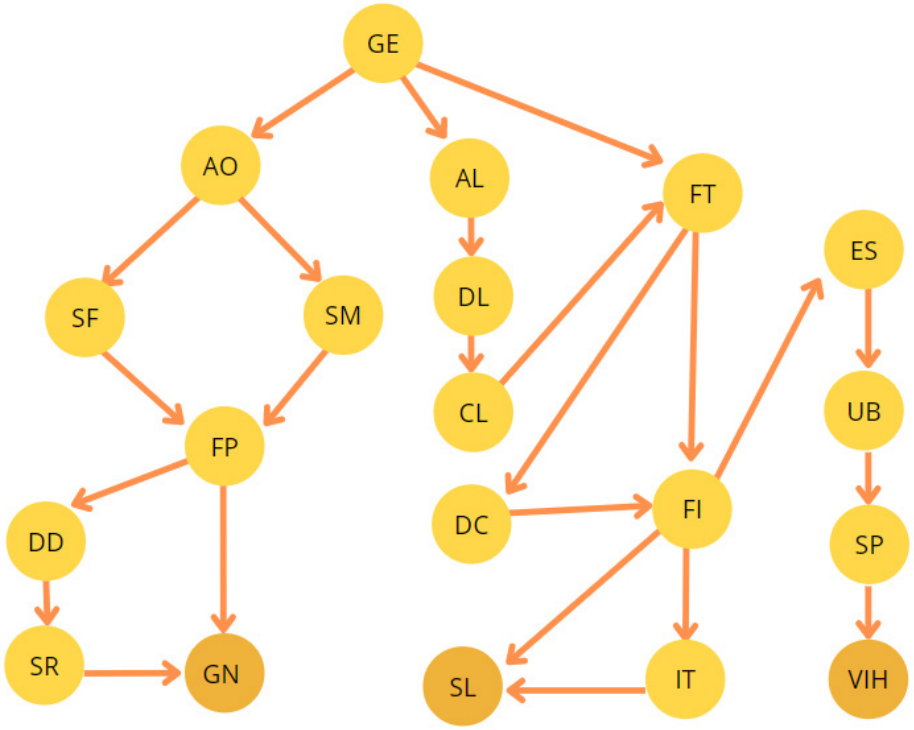

Fig. 2. Tree of knowledge of symptoms

Design model

Platform specification: At this point, the tools that were used to carry out the implementation of the intelligent system are specified. As can be seen in Table 7, it mentions the main aspects that will be developed in the technical design and architecture of the intelligent system.

Table 7. Design table

Design Model	Especificación del sistema inteligente
Software	Visual Studio Code.
Hardware	Adaptable for any mobile and desktop device, with a minimum of 2GB of RAM.
Programming language	The Python programming language was used and SQL Server 2019 as a database manager.
Knowledge representation	Rules are established and implemented in the source code of the intelligent system.

Software architecture. This section represents the operation of the intelligent system when acquiring new knowledge, as well as for the detection of venereal diseases. Likewise, the interaction of the knowledge base with the user's symptoms, as shown in Figure 3.

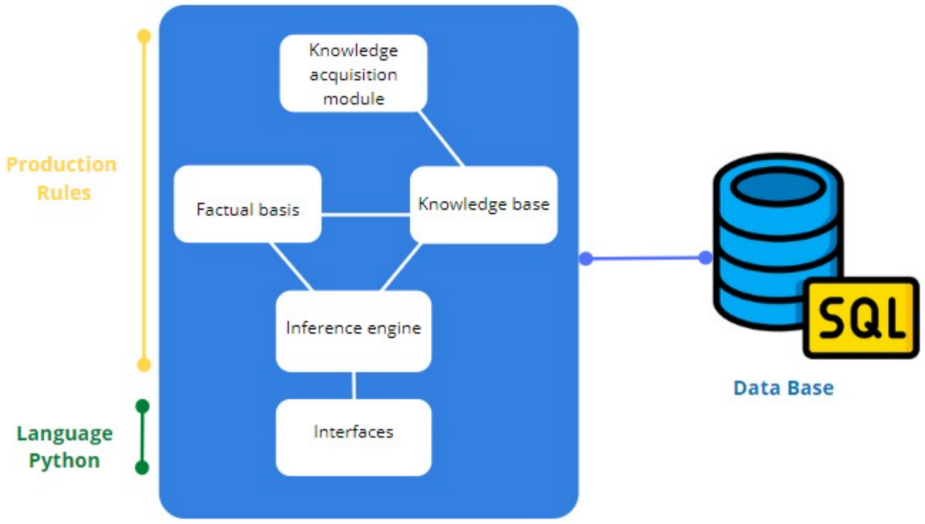

Fig. 3. Software architecture

- Knowledge acquisition module: through this module the information updates of the intelligent system are carried out, in such a way that it allows keeping its knowledge up-to-date in order to simulate the human expert.
- Knowledge base: in this module all the knowledge of the intelligent system for the simulation of the human expert is stored and the rules of inference are also found.
- Fact base: these are the main characteristics for the operation of the expert system, since from them the result can be simulated and deduced based on the information.
- Inference engine: this program is the one that solves the problem based on rules or calculations, using the knowledge base and the facts base, finally giving a solution as a human expert.
- Interfaces: this module represents the communication between the intelligent system and the user, it is here where the facts are entered so that the system can simulate the expert. In addition, the interface must be pleasant and easy to use for the user.

As a first instance, the knowledge base that will allow us to obtain all the data regarding the symptoms of the diseases and possible treatments is declared. Next, the inference of the data is made with the use of the knowledge base and the facts registered by the user. Finally, the intelligent system shows the disease found and the possible treatment.

Database diagram. At this point, the relational diagram of the database is represented, which functions as a knowledge base for the expert system, the database is shown in Figure 4.

```
symptom_map = {}
tratament_map = {}
#THE KNOWLEDGE BASE IS INSTANTIATED
def pre_process():
    global diseases_ls, diseases_sym, symptom_map, tratament_map
    diseases = open("diseasess.txt")
    diseases_content = diseases.read()
    diseases_ls = diseases_content.split("\n")
    diseases.close()
    for cons_disease in diseases_ls:
        disease_new_file = open("Symptoms/"+cons_disease+".txt")
        disease_new_data = disease_new_file.read()
        symp_list = disease_new_data.split("\n")
        diseases_sym.append(symp_list)
        symptom_map[str(symp_list)] = cons_disease
        disease_new_file.close()
        disease_new_file = open("tratament"+cons_disease+".txt")
        disease_new_data = disease_new_file.read()
        tratament_map[str(cons_disease)] = disease_new_data
        disease_new_file.close()
#THE INFERENCE ENGINE IS DONE
def identify_disease(*argument):
    symp_ls = []
    for symptom in argument:
        symp_ls.append(symptom)
    return symptom_map[str(symp_ls)]

def get_tratament(c_disease):
    return tratament_map[str(c_disease)]
#THE RESULT IS DISPLAYED ON THE INTERFACE
def not_find(c_disease):
    print("")
    identity_disease = c_disease
    tratments = get_tratament(identify_disease)
    print("")
    print("The most likely disease you have is %s\n" %(identity_disease))
    print("The common medications and procedures suggested by other real doctors are: ")
    print(tratments+"\n")
```

Fig. 4. Pseudocode of the intelligent system

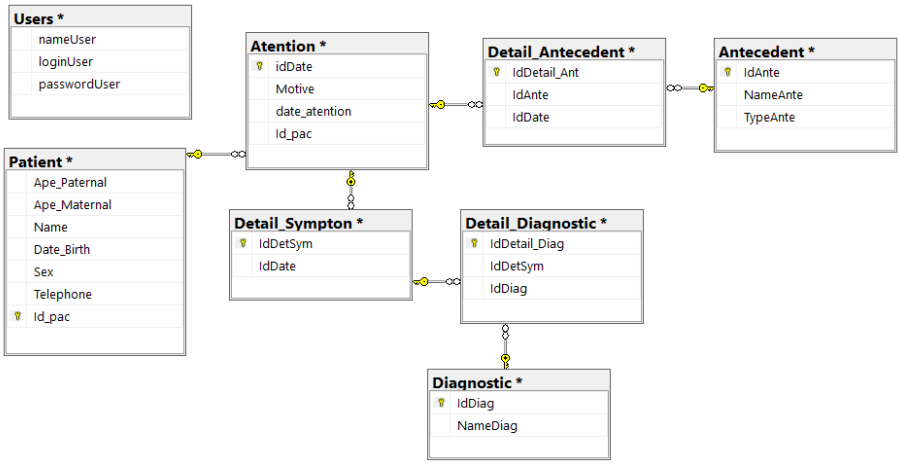

Fig. 5. Relational database diagram

4 Results and discussions

4.1 About the implementation of the design model

The decision tree based on symptoms of venereal diseases was used, defining its variables as shown in Table 5. Likewise, the logic was established through the Python language for the most accurate identification of said diseases, since this programming language contains a great contribution to intelligent systems which allows us to use different libraries that can more quickly and efficiently identify the user's symptoms.

On the other hand, the main task of the decision tree is to be able to classify the greatest number of possible symptoms that the patient may present, and based on this, it can make a more accurate prediction, as shown in Figure 2. In addition, it can be seen in Table 5 that the prediction is made up of Boolean and ordinal variables. Likewise, a user-friendly interface was established, which is not difficult to use and provides security in your information.

Figure 6 shows the home tab where the user will go on to select the symptoms they present. In Figure 7 shows the diagnostic view that identifies the intelligent system. Finally, Figure 8 shows the view of the acquisition of knowledge by the intelligent system, in which only administrators or specialists in the field have access.

Prototypes. At the top of the test module, there is a selected symptoms window that allows the user to view and remove the chosen options. Likewise, below them are the options of the symptoms that will be selected by the user with respect to the discomfort that they present. In addition, a "Next" button was added that allows you to see the other symptoms.

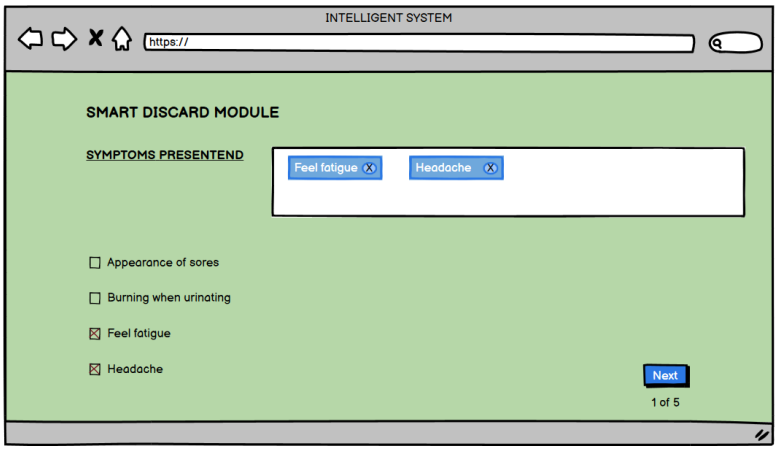

Fig. 6. Test module prototype

Once the user has finished selecting the symptoms they are suffering from, the intelligent system displays a diagnosis of the disease detected and the phase it is in. Likewise, it offers a suggestion for the treatment of the disease if you will find information in its knowledge base, otherwise I would recommend you go to a medical center

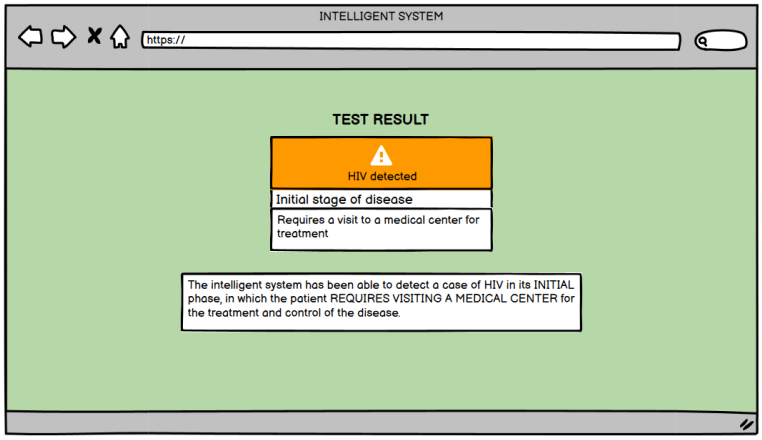

Fig. 7. Result module prototype

The knowledge management module allows you to keep updated information regarding the symptoms of diseases, access to this module is restricted to users who are experts in the field. As a first step, the user must select the disease that they would like to update, after which they can modify some symptoms associated with this disease or they can also add a new one.

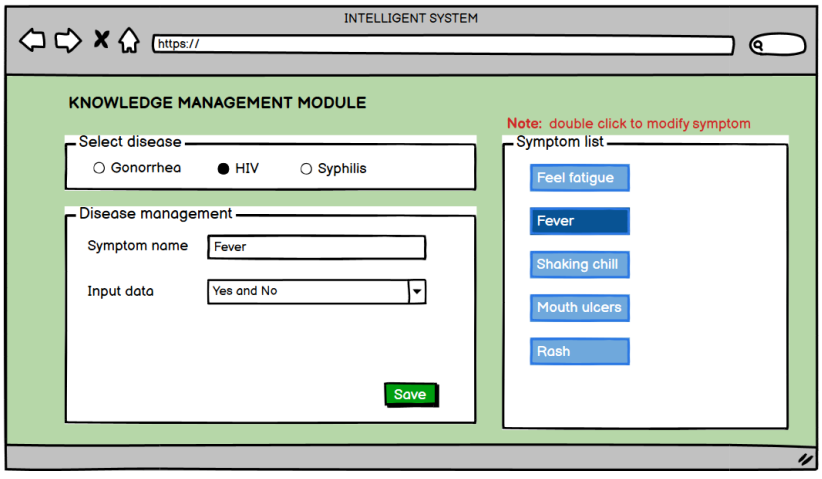

Fig. 8. Knowledge management prototype

Validation of the design model with experts and users. At this point, the results of the quality level validation were shown to 10 experts from different fields, who are trained in the design model, knowledge-based systems, expert systems, and health-based systems. Criteria such as Usability, Scalability, Feasibility, Innovation, and Technology were used in the validation. The questions used were made with the Likert scale with the answer option: 1 (very low), 2 (low), 3 (regular), 4 (high) and 5 (very high) [22], [23]. The questions that were applied in the validation measure the degree of acceptance of the expert system by those who know these applications. Table 8 shows the result of the validation by the experts, as well as the questions that were used in each criterion and the level of quality, obtained from the calculations obtained by the mean and standard deviation (S.D.) of each question, the calculation of the mean, allowed to establish the range of the quality level. This result is similar to that obtained by the author [11] who has a high approval of the design.

Likewise, a System Usability Study (SUS) was also developed for 30 different users, in which different questions were established based on the system's usability criteria, with response options based on the Likert scale, such as 1 (very low), 2 (low), 3 (regular), 4 (high) and 5 (very high), resulting in a high approval rating from users who tested the system. Table 9 shows the result of the evaluation by the different users, in addition to displaying the various questions that were used in the usability criterion, as well as the level of quality obtained by calculating the mean and the standard deviation (S.D.) of each question and in general.

Table 8. Validation results by experts

Criterion	Questions	Mean	S. D	Quality
Usability	The system has a loading time of fewer than 5 seconds.	4.10	0.56	High
	The system is user friendly	4.30	0.67	High
	The system is perfectly divided for user understanding	4.10	0.56	High
	The system can work in any browser	4.20	0.78	High
	The system has a user-friendly design	4.70	0.67	very high
Scalability	The database has a fast response time	4.00	0.47	High
	The system design works under a programming structure	4.20	0.91	High
	The system is adaptable for any device	4.40	0.69	High
Feasibility	The budget covers cloud hosting	3.60	0.84	High
	The development of the system had some cost	3.80	0.63	High
	Business strategies are implemented for efficient spending of the intelligent system	4.20	0.91	High
Innovation	Performs a quick discard of venereal diseases to users	4.50	0.70	very high
	It is a system with continuous knowledge acquisition	4.20	0.78	High
	It is developed to implement more detection modules for other diseases	4.10	1.10	High
Technology	A specialized programming language for intelligent systems was used	4.00	0.47	High
	A transactional database was used for queries and storage	4.00	0.47	High
	An interface design framework is used	4.30	1.05	High
Total Average and Final Quality Level		4.16		High

Table 9. Validation results by users

Criterion	Questions	Mean	S. D	Quality
Usability	The general appearance of the system is nice.	4,53	0,63	Very High
	Navigation between options is clear.	4,20	0,48	High
	The interface has a clear structure and organization.	4,37	0,72	High
	The system has a fast response time.	4,33	0,76	High
	The system in general is easy to use.	4,37	0,81	High
	The number of steps to perform the query is acceptable.	4,47	0,63	High
	the inquiry form explains its function.	4,40	0,72	High
	The legibility of the information generated is adequate.	4,73	0,52	Very High
	By using different browsers, such as Google Chrome, among others. the appearance and optimization are similar in all of them.	4,37	0,76	High
	In general, I consider the usability of this system to be good.	4,47	0,78	High
Total Average and Final Quality Level		4,42		High

4.2 About the methodology

It should be noted that the methodologies provide various techniques, tools, and functions for the development of a project, there are multiple methodologies, which are also agile, which provide help to the development team so that the project is in optimal conditions, in addition to monitoring growth of the project [24].In this section, each of these various methodologies was investigated, to which a brief comparison will be made with the methodology applied in the project.

In the project, the application of the Common kads methodology was chosen, which is established in knowledge-based systems, in addition, it is a methodology that is dedicated to the analysis and generation of knowledge of an organization.

On the part of agile methodologies, mention is made of the SCRUM method, which is called a work environment, in which integrated people can adapt to complex situations, in such a way that they can provide solutions and deliver products with the highest quality and possible value [25]. In addition, this methodology is responsible for minimizing all kinds of problems during the development of the project, since it is an environment that is usually constantly changing.

On the other hand, another commonly used agile methodology is extreme programming or also known as agile XP methodology, which was used to manage software development teams regardless of the number of members [26]. In other words, it is based on strengthening the links between collaborators, which will be part of the success of the software implementation, in addition, it promotes group work, and prioritizing learning, this methodology is essential for changing projects or those that do not have precise requirements. Table 10 will detail a brief comparison between the agile methodologies mentioned, and the methodology used in the project, highlighting its advantages and disadvantages.

Table 10. Comparison of methodologies

Methodology	Advantages	Disadvantages
Common KADS	Emphasize analysis in the organization	It is an extensive and complex methodology.
	Dedicated to knowledge systems	There are no concrete examples, only partially
	Its development approach reflects multiple views of the project.	
	It is the most used for the topic of a system based on knowledge.	A lot of information is related to the methodology, which confuses at the time of implementation.
	It offers a framework that specifies the knowledge that differs from the implementation.	
Scrum	The results of each stage are displayed, without the need to wait for the completion of the project.	The teams must be made up small, otherwise, the effect of the method would not be applied.
	It provides flexibility and adaptation to different management models.	If the tasks and their deliverables are not defined, the effect of the methodology is lost.
	The risks that may appear are solved quickly and efficiently due to the intervention of the team.	You cannot advance with the phases in case you have pending jobs.
Extreme Programming (XP)	Provides comfortable communication with the project stakeholder.	In terms of cost, this varies according to the number of processes.
	The software is stable thanks to continuous testing.	A long time is required for the elaboration of the project.
	Less identification of risks in project development.	Less identification of risks in the development of the project. The client's intervention delays the development of the work.

5 Conclusion and future work

In short, an expert system capable of providing diagnoses and possible treatments of venereal diseases was proposed, aimed at people who need safe and correct information, as well as various health specialists, who will provide them with facilities when it comes to providing a diagnosis. In the present research work, the Common kads l methodology was applied and based on this, the decision tree was used, which gave us the facility to classify the various symptoms that a patient could present, and thus have an exact prediction about the disease that suffers. Resulting in an interface in which the patient will be able to register her symptoms, and in response will obtain the diagnosis of the disease that she could suffer from, as well as a possible treatment. One of the limitations that was presented throughout the project is the implementation of the methodology, although it is true that Common KADS is recommended for topics related to knowledge, the information on its structure varies. For future work it is recommended to analyze the benefits of expert systems in the health area since they provide facilities for diagnosis or treatment, it is also recommended to continue research on the implementation of expert systems applying other algorithms.

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