

Knowledge Based System for Diagnosing Throat Problem CLIPS and Delphi languages

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Abstract: Background: Throat problems are common, include a variety of abnormal or unusual sensations or problems of the throat and have. You've probably had a sore throat. The cause is usually a viral infection, but other causes include allergies, infection with strep bacteria or the leaking of stomach acids back up into the esophagus, called GERD. Other problems that affect the throat include Tonsillitis, Cancer, Croup, - inflammation, Laryngitis **Objectives:** The main goal of this expert system is to get the appropriate diagnosis of disease and the correct treatment by presenting suggestions on Throat disease to the user by asking about symptoms. **Methods:** CLIPS and Delphi languages were used as the main tools for designing our Knowledge based system.

Keywords: Artificial Intelligence, Knowledge Based, Expert Systems, CLIPS, Throat problems

1. INTRODUCTION:

Pharynx, (Greek: "throat") cone-shaped passageway leading from the oral and nasal cavities in the head to the esophagus and larynx. The pharynx chamber serves both respiratory and digestive functions. Thick fibres of muscle and connective tissue attach the pharynx to the base of the skull and surrounding structures. Both circular and longitudinal muscles occur in the walls of the pharynx; the circular muscles form constrictions that help push food to the esophagus and prevent air from being swallowed, while the longitudinal fibres lift the walls of the pharynx during swallowing[1].

The pharynx consists of three main divisions. The anterior portion is the nasal pharynx, the back section of the nasal cavity. The nasal pharynx connects to the second region, the oral pharynx, by means of a passage called an isthmus. The oral pharynx begins at the back of the mouth cavity and continues down the throat to the epiglottis, a flap of tissue that covers the air passage to the lungs and that channels food to the esophagus. Triangular-shaped recesses in the walls of this region house the palatine tonsils, two masses of lymphatic tissue prone to infection. The isthmus connecting the oral and nasal regions is extremely beneficial in humans. It allows them to breathe through either the nose or the mouth and, when medically necessary, allows food to be passed to the esophagus by nasal tubes. The third region is the laryngeal pharynx, which begins at the epiglottis and leads down to the esophagus. Its function is to regulate the passage of air to the lungs and food to the esophagus.

Two small tubes (eustachian tubes) connect the middle ears to the pharynx and allow air pressure on the eardrum to be equalized. Head colds sometimes inflame the tubes, causing earaches and hearing difficulties. Other medical afflictions associated with the pharynx include tonsillitis, cancer, and various types of throat

paralyses caused by polio, diphtheria, rabies, or nervous-system injuries.

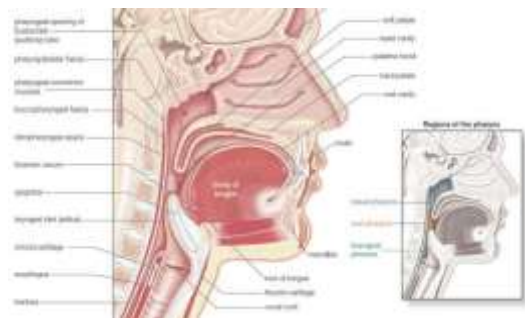


Figure 1: Human Throat(Pharynx) [1].

Throat symptoms can vary greatly in character and severity depending on the underlying disease, so we devolved knowledge base system using clips and Delphi languages to get the appropriate diagnosis of disease and the correct treatment by presenting suggestions on Throat disease to the user by asking about symptoms.

2. LITERATURE REVIEW

There are many Knowledge base systems that have talked about diagnosing diseases whether they are related to humans, animals or even plants[7-59]. But there is no specialized expert system for diagnosis of Throat diseases available free and Use a language CLIPS Linked with Delphi. This expert system was characterized to be easy to use by specialists and People concerned. This is due to the coordinated application interface. proposed expert system is specialized in the diagnosis of 10 Throat diseases. There is a lot of kind and symptom can affect the throat such as[2]:

- Change in voice, such as muffled or altered speech or hoarseness
- Dry throat

- Feelings of itchiness or tickling in the throat
- Persistent irritation
- Phlegm or mucus buildup due to postnasal drip, infection, or inflammation
- Sore throat
- Swallowing problems, such as difficulty swallowing (dysphagia) or painful swallowing (odynophagia)
- Swollen tonsils
- Throat lumps or growths
- Throat pain
- White patches on the tonsils and throat

Depending on the cause, throat symptoms can last briefly and disappear relatively quickly, such as when symptoms develop during the common cold. Throat symptoms can also recur over a longer period of time, such as when symptoms are caused by throat cancer. So we build a knowledge base system to help specialists and normal user diagnosing throat problem.

An expert system is a computer program that uses artificial intelligence (AI) technologies to simulate the judgment and behavior of a human or an organization that has expert knowledge and experience in a particular field [3]. As shown in figure 2 the main component of expert system knowledge base inference engine, and User Interface



Figure 2 main component of expert system

3. MATERIALS AND METHODS

The proposed expert system performs diagnosis for 10 diseases throat problem. The proposed expert system will ask the user to choose the correct symptoms in each screen. At the end of the dialogue session, the proposed expert system provides the diagnosis and recommendation of the disease to

the user. Figure 3 show the main screen of throat expert system :

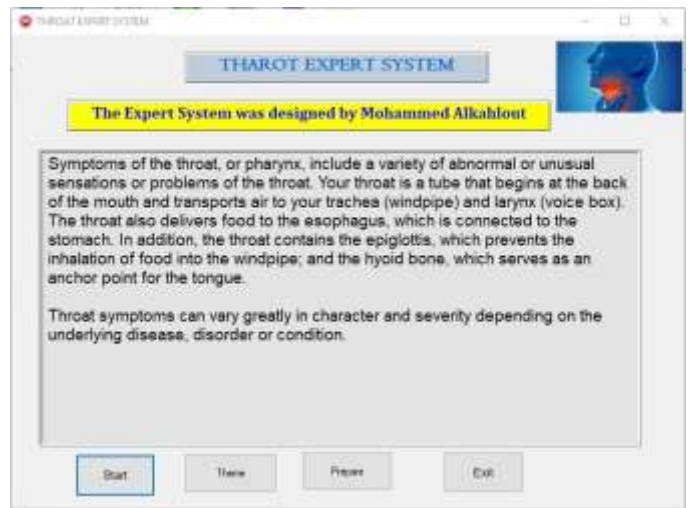
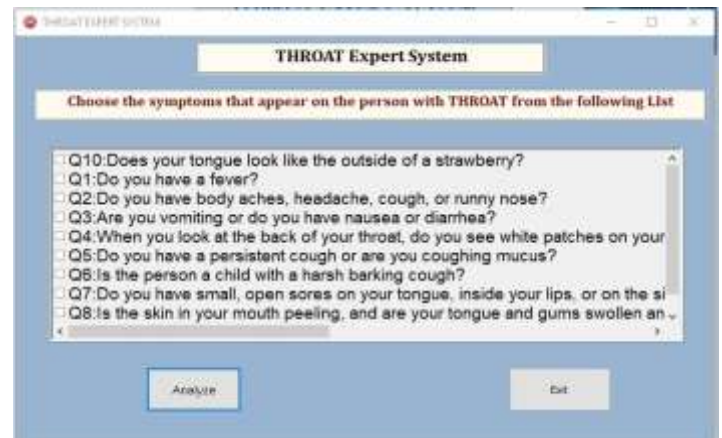


figure 3: main screen of expert system

figure 4 shows a sample dialogue between the expert system



and the user.

Figure 4: Dialogue between the expert system and the user

Figure 5 shows how the users get the diagnosis and recommendation

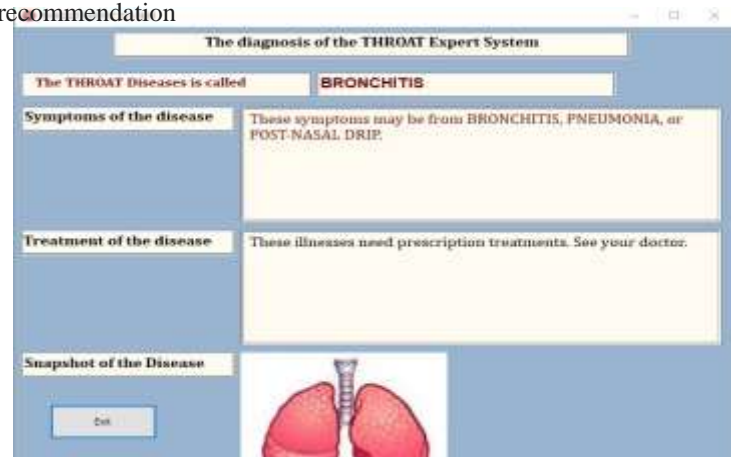


Figure 5 : Diagnosis and recommendation

4. KNOWLEDGE REPRESENTATION

The main source of the knowledge for this expert system is based on Family Doctor website. [4] The diagnosis is based on the Decision Trees shown in figure 6

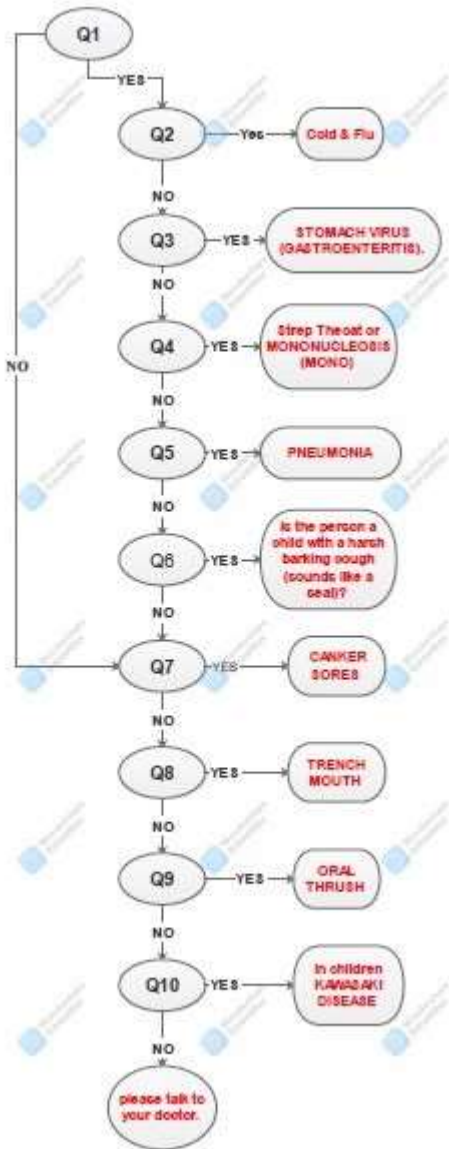


Figure 6 : Decision Tree for Throat Diagnosis

List of questions for Decision Tree listed in Table 1

Table 1: List of Questions for Decision Tree

Q1:Do you have a fever?
Q2:Do you have body aches, headache, cough, or runny nose?
Q3:Are you vomiting or do you have nausea or diarrhea?

Q4:When you look at the back of your throat, do you see white patches on your tonsils?
Q5:Do you have a persistent cough or are you coughing mucus?
Q6:Is the person a child with a harsh barking cough?
Q7:Do you have small, open sores on your tongue, inside your lips, or on the sides or back of your mouth?
Q8:Is the skin in your mouth peeling, and are your tongue and gums swollen and red?
Q9:Do you have white patches and redness on your tongue or on the sides or back of your mouth?
Q10:Does your tongue look like the outside of strawberry?

The captured knowledge has been converted into CLIPS Knowledge base syntax (Facts and Rules). This expert system defined the symptoms for problems of the throat. The scope of our Knowledge base system is the following throat problems: COLD or FLU, STOMACH FLU, STREP THROAT, PNEUMONIA, A dry barking cough, Bronchitis, CANKER SORES, TRENCH MOUTH, ORAL THRUSH, KAWASAKI DISEASE.

Here some overview about above disease cover from our expert system [5].

Cold or flu : The common cold, including chest cold and head cold, and seasonal flu are caused by viruses. Use over-the-counter cold medications to relieve symptoms including sore throat, runny nose, congestion, and cough .

STOMACH FLU : When you have diarrhea and vomiting, you may say you have the "stomach flu." These symptoms often are due to a condition called gastroenteritis. With gastroenteritis, your stomach and intestines are irritated and inflamed. The cause is typically a viral or bacterial infection.

STREP THROAT : Strep throat is an infection of the throat and tonsils caused by a bacteria called group A *streptococcus* , also known as *Streptococcus pyogenes*. This bacteria lives in the nose and throat. You can get the infection from someone who is sick with strep A bacteria or is a carrier of it.

PNEUMONIA : is a lung infection that can range from mild to so severe that you have to go to the hospital. It happens when an infection causes the air sacs in your lungs (your doctor will call them alveoli) to fill with fluid or pus. That can make it hard for you to breathe in enough oxygen to reach your bloodstream.

Bronchitis: is when the tubes that carry air to your lungs, called the bronchial tubes, get inflamed and swollen. You end up with a nagging cough and mucus. There are two types:

- **Acute bronchitis**. This is more common. Symptoms last a few weeks, but it doesn't usually cause problems past that time.

- **Chronic bronchitis.** This one is more serious. It keeps coming back or doesn't go away.

A canker sore : is a small, shallow open wound (or ulcer) in your mouth that can make eating and talking uncomfortable. They're also known as aphthous ulcers. There are a few types of canker sores:

- **Minor canker sores.** These may show up three or four times a year. They typically happen in people ages 10 to 20. They're less than 1 centimeter across and heal in about a week with no scarring.
- **Major canker sores.** These are less common. The ulcers are bigger and can last more than 2 weeks. They often heal with scarring.
- **Herpetiform canker sores.** These are rare and show up as clusters of tiny ulcers. They usually heal in about a week.

Trench mouth : is an infection that causes swelling (inflammation) and ulcers in the gums (gingivae). The term trench mouth comes from World War I, when this infection was common among soldiers "in the trenches"[6].

ORAL THRUSH : If you notice a strange white rash inside your mouth, you may have a condition called thrush. It's also called oral candidiasis. It's an infection caused by the candida fungus, which is yeast. You can get it in your mouth and other parts of the body. It can cause diaper rash in infants or vaginal yeast infections in women. Anyone can get thrush, but it happens most often to babies and toddlers, older adults, and people with weakened immune systems.

KAWASAKI DISEASE : is an illness that causes blood vessels to become inflamed, almost always in young children. It's one of the leading causes of heart disease in kids. But doctors can treat it if they find it early. Most children recover without any problems.

In this research the problem of the throat problem are implemented by methodology of rule based systems. One of the well-known methods of representation of knowledge in the expert systems is the productive representation as the CLIPS (production system). CLIPS keep in memory a fact list, a rule list, and an agenda with activations of rules. Facts in CLIPS are simple expressions consisting of fields in parentheses. Groups of facts in CLIPS, usually follow a fact-template, so that to be easy to organize them and thus design simple rules that apply to them.

5. LIMITATIONS :

The current proposed expert system is specialized in the diagnosis only the following 10 Symptoms for Throat Problem, COLD or FLU, STOMACH FLU, STREP THROAT, PNEUMONIA, A DRY BARKING COUGH, BRONCHITIS, CANKER SORES, TRENCH MOUTH, ORAL THRUSH, KAWASAKI DISEASE.

6. SYSTEM EVALUATION

Internal evaluation was done by Prof. Dr. Samy Abu Naser concerning functionality, performance, efficiency, user interfaces and ease of use. And for medical issue I ask Doctor Mustafa Al-kahlout who is a medical director at AL-Naser Hospital At Gaza strip Where the results were highly satisfactory and closely matched to the actual results according to the basic symptoms given .

7. FUTURE WORK

This expert system is considered to be a base of future ones; more Throat diseases are planned to be added and to make it more accessible to users from anywhere at any time.

8. CONCLUSION

In this paper, has presented an expert system for diagnosis the Throat problem, which provides the patients with the diagnosis, recommendation and treatment, based on the expert system knowledge base and data collected from the patients This expert system saves the patient time and effort by allowing the patient to diagnose the Throat Problem faster and more accurate than the traditional diagnosis. This expert system does not need intensive training to be used; it is easy to use and has user friendly interface It was developed using CLIPS Expert System language and Delphi Language. An initial evaluation of the expert system was carried out and a positive feedback was received from the users.

9. EXPERT SYSTEM SOURCE CODE

```
(defrule disease1
(Q1:Do you have a fever?)
(Q2:Do you have body aches, headache,
cough, or runny nose?)

(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "1" crlf )
)

(defrule disease2
(Q1:Do you have a fever?)
(Q3:Are you vomiting or do you have
nausea or diarrhea?)

(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "2" crlf )
)
```

```

(defrule disease3
(Q1:Do you have a fever?)
(Q4:When you look at the back of your
throat, do you see white patches on your
tonsils?
)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "3"  crlf )
)
(defrule disease4
(Q1:Do you have a fever?)
(Q5:Do you have a persistent cough or are
you coughing mucus?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "4"  crlf )
)
(defrule disease5
(Q1:Do you have a fever?)
(Q6:Is the person a child with a harsh
barking cough?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "5"  crlf )
)
(defrule disease6
(Q7:Do you have small, open sores on your
tongue, inside your lips, or on the sides
or back of your mouth?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "6"  crlf )
)

defrule disease7
(Q8:Is the skin in your mouth peeling,
and are your tongue and gums swollen and
red?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "7"  crlf )
)

(defrule disease8
(Q9:Do you have white patches and redness
on your tongue or on the sides or back of
your mouth?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "8"  crlf )
)

(defrule disease9
(Q10:Does your tongue look like the
outside of a strawberry?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "9"  crlf )
)
(defrule endline
(disease identified)
=>
(close fdatao)
)

(defrule readdata
(declare (salience 1000))
(initial-fact)
?fx <- (initial-fact)
=>
(retract ?fx)
(open "data.txt" fdata "r")
(open "result.txt" fdatao "w")

(bind ?symptom1 (readline fdata))
(bind ?symptom2 (readline fdata))
(bind ?symptom3 (readline fdata))
(bind ?symptom4 (readline fdata))
(bind ?symptom5 (readline fdata))
(bind ?symptom6 (readline fdata))
(bind ?symptom7 (readline fdata))
(bind ?symptom8 (readline fdata))
(bind ?symptom9 (readline fdata))
(bind ?symptom10 (readline fdata))

(assert-string (str-cat "(" ?symptom1
"))")
(assert-string (str-cat "(" ?symptom2
"))")
(assert-string (str-cat "(" ?symptom3
"))")
(assert-string (str-cat "(" ?symptom4
"))")
(assert-string (str-cat "(" ?symptom5
"))")
(assert-string (str-cat "(" ?symptom6
"))")
(assert-string (str-cat "(" ?symptom7
"))")
(assert-string (str-cat "(" ?symptom8
"))")
(assert-string (str-cat "(" ?symptom9
"))")
(assert-string (str-cat "("
?symptom10"))")

(close fdatao)

```

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