EXPERT SYSTEM IN INTERNAL DISEASES
(ESIRG)
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**ABSTRACT:**

In this paper an attempt has been made to design a package for expert system in internal diseases, we named our system (ESIRG). The package is composed of respiratory system and gastrointestinal system, which represent the internal diseases in the human's body.

ESIRG has 7 functions for each system. In gastrointestinal system ESIRG has about (44) diseases and (23) diseases for respiratory system. Also ESIRG can diagnose these diseases and determine treatment according to the signs and symptoms.

In addition to that doctor/user can see what is the causes of that diseases and another functions we will explain them in this paper. Our expert system has been implemented using turbo prolog programming language.

**1- INTRODUCTION:**

Expert system is one of the most important field of A.I. because it represent many utilization in various domains like (medicine, mathematics, ... etc.). To facilitate the implementation of the application, expert system which enable user to enter his application and operate it.

In the medical area we have very large branches such as: nervous system, respiratory system, blood system, gastrointestinal system .... etc. this research focus on the respiratory system and gastrointestinal system because these systems contain a large no. of diseases. We use TURBO PROLOG language in programming this system in MS-DOS by using IBM-PC.
1-MEDICAL ARTIFICIAL INTELLIGENCE:

The medical artificial intelligence focuses on diagnosis of the diseases to determine the treatment of these diseases. In the early 1960s, researchers began to make the artificial intelligence programs. During the years from 1960, we can find important programs which specifies in this area. These programs are (3):

1- PIP (present illness program)
2- CASNET
3- INTERNIST
4- MYCIN

Any medical program stands for medical research because the medical information needs to understand and discuss with a doctor. Some programmers who programmed a medical program worked with doctors so they could be more understanding for the nature of medicine. During working in the medical area, the researchers discovered that the largest problem in this area is the representation of information which taken from the doctors. But after programming the four previous programs, this problem has been solved. [3]

3-THE MEDICAL PROBLEMS IN THE EXPERT SYSTEM:

In the medicine science there is no constant base or constant principle about the diagnosis of diseases, for example if person (named a) suffers from a disease and another person (named b) suffers from the same disease, it is not necessary that they have the same signs and symptoms because of several reasons, these reasons are:

1- The natural differences of the body in (A and B).
2- The immunity difference of the body against the diseases in (a and b).
3- Psychological differences in (A and B).

These reasons were about the patient and now about the doctors; every doctor depends on this information and his experience in diagnosing diseases.
Even in the treatment every doctor gives the patient a treatment depending on the diagnosis the disease and the case of the patient at that time. From that we can understand the medical problems in the expert systems.

4- CHARACTERISTICS OF ESIRG :-

In the ESIRG we will explain two important points, these points are:

4-1 KNOWLEDGE REPRESENTATION :-

In any expert system we have a large no. of information, for that we must represent these information on a way which give us best results.

The information which have been used in (ESIRG) is represented by diseases, treatment, causes) such as:

- disease (name of diseases, part of disease, list of symptoms), list of treatment, list of causes).

All argument was written as a string except list of signs & symptoms which was written as a list of real no. so that we can represent the grades of the causes now. We will explain how it would be done. Any real no. consist of no. on the left side of point and no. on the right side of point. The left side No. represents the case and the right side No. represents the grades of this case, now we will take representation of “temperature”.

We represented the “temperature” by No. (16) but the “temperature” can be normal temperature (fever) or decrease in temperature.

We represented these cases such that:

- Normal temperature --------------- 16.0
- Fever ----------------------------- 16.1
- Decrease in temperature ---------- 16.2

We can see the constant No. (16) which is referring to the case “temperature” and the variable No. (0, 1, 2) which are referring to (normal, high, decrease) of “temperature” now after we explain the way that represent the important part of our
information we will remember the important characteristics of this way:
1- we represent list of signs and symptoms by real no. not by a
trying because it takes smaller size of memory.
In our system we have about [70] diseases, if we suppose
the "decrease in temperature" happened in [30] diseases,
instead of writing this sentence about [30] times, we write
the no. [16.2] about [30] times. also for search operation it
takes less time.
2- We represented the cases grades by simplicity and
efficiency.
4-2 THE INTERFACE WITH USERS:
A good representation of information is not enough to
make good system but we must present a good interface with
the users. Now we will remember the important characteristics
of interface with user in ESIRG:
1- The Esirg covers large no of possibility for user's
requirement.
2- We used menus in ESIRG to make it easy.
3- The egirs provides messages to the user, these messages
are:
A- Messages indicates the type of user's error.
B- Messages indicates in which part of ESIRG the user is
working.
C- Messages appear to the user for selecting from menu or
from keyboard or (hit any key) to continue.
4- Using terms serves the the experts and non-experts, but
this point not executed in every case because the medical
terms are very difficult to convert to common terms.
5- FUNCTIONS OF ESIRG:–

ESIRG has (7) functions for each system (respiratory system and gastrointestinal system), now we will explain each function (see figure 1):

5-1 CLASSIFICATION OF DISEASES:

Each system in human's body consists of several parts, each part suffers from some diseases. This function displays all diseases in a part (we will select it).

For example, if the user wants to know the diseases in the "stomach", he will select "stomach". Moreover ESIRG has a common disease such as (CHOLERA, WHOOPING COUGH) that does not happen in a specific part, for this reason, these diseases have been put under the title "common" diseases (see appendix 1,2).

5-2 DIAGNOSIS OF DISEASES:

This function is responsible for the diagnosis of diseases and gives the desired treatment to the user (patient). ESIRG has several questions to the user (patient), with each question the probability answers are found in menus and the user selects the desirable answer and according to that, the result will be one of the following:

1- The user suffers from a specific disease.
2- The user suffers from one of the probable diseases, if these answers are part from these diseases.
3- The results of the user's answers are useless, because the correlation among these answers is missing.

Now we will explain the two important questions "HOW?" and "WHY?". In all questions we have the selections "WHY?" with other answers, this selection displays the importance of that question in diseases. At the end of
questions, and after the ESIRG give the result, it display how it concludes this result. [see the questions in appendix 3].

5-3 INFORMATION ABOUT DISEASES:—

When we enter the name of any disease that present in the ESIRG, the ESIRG will display the causes, treatment, part, signs & symptoms of disease.

5-4 COMMON DISEASES IN (PART, CAUSES, TREATMENT, SIGNS & SYMPTOMS):—

If we want to know the common diseases in some of information, these information enter by the user, these information including:
A- Part in human's body (respiratory or gastrointestinal)
B- Treatment
C- Causes
D- Signs & Symptoms
It is very useful function in ESIRG.

5-5 APPEND (CAUSES, TREATMENT):—

In the ESIRG the user can append a new treatment to any existing disease and can append a new causes for any existing disease, whenever he need that.

5-6 DELETION (DISEASES, TREATMENT, CAUSES):—

We can remove any disease from ESIRG by using this function. Moreover we can remove any causes from any disease.

The important point in this function whenever any treatment became not active to avoid the disease or at least to decrease the danger of that disease, in this case we can delete this treatment from ESIRG.
5.7 INSERTION NEW DISEASES :-

If a new disease discovered we can add it to ESIRG with all the information (part, causes, treatment, signs, & symptoms).

6. CONCLUSION :-

We introduced the (ESIRG) which is related with two systems in human's body (respiratory systems & gastrointestinal system). The doctor/user can make use of (7) functions provided by ESIRG for each of (respiratory system & gastrointestinal system).

ESIRG the ability to display about (44) diseases in gastrointestinal system and about (23) diseases in respiratory system. Also ESIRG can diagnose these diseases and determine the treatment according to the signs and symptoms. In addition to that the doctor/user can see what are the causes of that diseases. Any specialist doctor can update on ESIRG data base by insert, delete and append any information. In ESIRG the doctor can see the common diseases in cause, treatment, part, signs & symptoms. In the appendix 4 of this of this paper we can see some of the output model from ESIRG.

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2. Donald A. Waterman "A guide to expert system"
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Appendix no. 1
1- Respiratory System's
2- Gastroentritis System Parts
   6. Colon 7. Small Intestine

Appendix No.2
1- Respiratory System Diseases :
   15. Bronchogenic Carcinoma 16. Pulmonary Infraction
   17. Pulmonary hydratid cyst ( Bronchias ) 18. pulmonary
   hydratid (trachea) 19. Pneumothorax 20. Croup of Trachea
   21. Croup of Bronchias 22. pulmonary Carcinoma
   23. Carcinoma of Trachea.

2- Gastroentritis System's Diseases :

APPENDIX 3

Common questions between both RESPIRATORY SYSTEM'S DISEASES & GASTROENTRITIS SYSTEM'S DISEASES :

1- Determine the age group of the patient?
   1-10 years  11-20 years  20-90 years

2- Determine the sex of the patient?
   Male  Female

3- Martial status?
   Single  Married

4- Does the patient smoke? ( No \ Yes )

5- Does the patient have alcoholic? ( No \ Yes )

6- Does the patient have general weakness?
   No general weakness  General weakness

7- Does the patient have headache?
   Severe headache  Light headache

8- The appetites.
   Normal appetites  Loss of appetites

9- Weight of the body?
   Normal  Increase in weight  Decrease in weight

10- Does the patient have chest pain? ( No \ Yes )
    Determine side of the pain?
    Pain in the middle of the chest
    Pain in the right side of chest
    Pain in the left side of the chest
11- Does the patient have difficulty in swallowing? (No\Yes)
12- Does the patient have cough? (Yes\No)
    Determine type of cough
    Dry cough
    Cough with sputum, light, white is color
      =
    yellow =
    =
    ,heavy, green, =
13- Does the patient have chronic cough? (No\Yes)
    Determine the severity of the cough?
    Severe cough light cough
14- Does the patient have sweating? (No\Yes)
    Where the sweating is happen?
    Sweat at all the time sweat at night
15- Does the patient have hoarseness of voice? (No\Yes)
16- Temperature?
    Normal
    Fever
    Decrease in temperature
17- Does the patient have vomiting? (No\Yes)
    Nature of the vomitus?
    Bloody vomitus
    No blood with vomitus
18- Does the patient have dehydration? (No\Yes)
19- Does the patient have dry mouth? (No\Yes)
20- Does the patient have nausea? (No\Yes)
21- Nature of pulse rate?
    Normal pulse rate
    Rapid pulse rate
    Slow pulse rate
    Irregular pulse rate
22- Blood pressure
    Normal blood pressure
    Increase in blood pressure
    Decrease in blood pressure
23- The amount of hemoglobin in blood?
   Normal in Hb
   Increase in Hb
   Decrease in Hb
24- ESR rate
   Normal ESR
   Increase in ESR
25- Percentage of bile pigments in blood?
   Normal bile pigments
   Increase in bile pigments in blood

Questions for RESPIRATORY SYSTEM'S diseases:

26- Does the patient have abdominal pain? (No/Yes)
   Determine the side of the pain?
   Pain in the middle of upper part of the abdomen
   = = right side of upper part of the abdomen
   = = left
   = middle of lower part of the abdomen
   = = right side of lower part of the abdomen
   = = left
27- Does the patient have gases? (No/Yes)
28- Does the patient feel any acidity at the upper part of the abdomen? (No/Yes)
29- The nature of faces?
   Normal faces
   Diarrhoea
   Constipation
   - The nature of diarrhoea?
     Diarrhoea normal
     Diarrhoea with blood
     = with mucus
30- Does the patient have bloody faces? (no/yes)
31-Does the patient have skin rash? (no / yes)
32-The amount of urine?
   normal amount of urine
   Increase in amount of urine
   Decrease in amount of urine
33-Color of the skin?
   Normal color
   Pal discoloration of the skin
   Yellow = = =
   Blue = = =
34-The nature of the shape of the abdomen?
   Normal abdomen shape
   Distention in upper right side of the abdomen = = left = = =
   = = lower right side of the abdomen = = = left = = =
   Fluid in the abdomen
   General distination
35-Does the patient have swelling? (no/yes)
   Determine the side of the swelling?
   Swelling in the liver = = = spleen
   = = = colon
   Swelling in the middle of upper part of the abdomen
   Swelling in the right side of upper part of abdomen
   Swelling in the middle of lower part of the abdomen
   Swelling in the right of lower part of abdomen
   Swelling in the left of lower part of the abdomen
36-Does the patient have tenderness? (no/yes)
   Determine the side of the tenderness?
   Tenderness in the middle of upper part abdomen = = Right side of = = =
   = = Left = = =
   = = Middle of lower part abdomen
== == Right side of the lower part abdomen
== == left side of lower part abdomen

General tenderness

37. Does the patient have sugar in urine? (no/yes)
   No sugar in urine
   Sugar in urine

38. Does the patient have blood in urine?
   No blood in urine
   Blood in urine

39. Does the patient have micro-organisms in urine? (no/yes)
   Determine the type of micro-organisms: cocci, bacilli, cocci and bacilli

40. Does the patient have micro-organisms in face? (no/yes)
   Determine the type of micro-organisms:
   Cocci, bacilli, cocci and bacilli

41. The amount of sugar in blood?
   Normal sugar
   Increase in sugar amount in blood
   Decrease = == == ==

42. Percentage of sodium in blood?
   Normal sodium
   Increase of sodium percentage in blood
   Decrease = == == ==

43. Percentage of potassium in blood?
   Normal potassium
   Increase of potassium percentage in blood
   Decrease = == == ==

44. Percentage of calcium in blood?
   Normal calcium
   Increase in Calcium
   Decrease in calcium
45- Percentage of uric acid in blood?
   Normal uric acid in blood
   Increase uric acid in blood
   Decrease = = =

46- Percentage of enzymes of liver?
   Normal enzymes of liver
   Increase enzymes of liver

47- Percentage of urea in blood?
   Normal urea
   Increase in urea in blood

48- Percentage of alkaline phosphates?
   Normal alkaline
   Increase in alkaline

49- Percentage of mylase?
   Normal mylase
   Increase a mylase

50- Percentage of protein in blood?
   Normal protein
   Decrease protein

51- Specific gravity of urine?
   Normal gravity of urine
   Increase in gravity of urine
   Decrease = = =

52- Percentage of WBC?
   Normal wbc
   Increase in wbc
   Decrease in wbc

QUESTIONS FOR GASTROENTERITIS SYSTEM'S DISEASES:
26- Does the patient have running nose?
   No running nose
   Running nose

27- Does the patient have sneezing?
   No sneezing, sneezing
28. Does the patient have tridness on exeration?
   - No tridness on exeration
   - Tridness on exeration

29. Does the patient have wheezes during the breathing?
   - No wheezes during the breathing
   - Wheezes during the breathing

30. Nature of breathing?
   - Normal breathing
   - Increase in breathing
   - Decrease in breathing

31. Does the patient have micro-organisms in sputum? (no/yes)
   - No tuber clous bacelli
   - Tuber clous bacelli

32. Does the patient have suffocation?
   - No suffocation
   - Suffocation

APPENDIX 4-

EXPERT SYSTEM IN INTERNAL DISEASES
THE RESPIRATORY SYSTEM
MAIN MENU

select your choice

classification of diseases
diagnosis of diseases
information about diseases
socialized diseases in (causes, treatment, sign & symptoms)
append (causes & treatment)
deletion (diseases, treatment, & causes)
insertion new diseases
compare between 2-diseases
exit
EXPERT SYSTEM IN INTERNAL DISEASES
THE RESPIRATORY SYSTEM
CLASSIFICATION OF DISEASES

Parts of diseases of respiratory system are:

- nose
- pharynx
- larynx
- trachea
- bronchus
- bronchias
- lung
- common
- exit

EXPERT SYSTEM IN INTERNAL DISEASES
THE RESPIRATORY SYSTEM
CLASSIFICATION OF DISEASES

- lung
  - pneumonia
  - tuberculosis
  - pulmonary carcinoma
  - pulmonary infarction
  - pneumo thorax
  - emphysema

*** No other disease ***

HIT ANY KEY
enter name of the diseases - asthma
the causes are :- air pollution

dust

the signs & symptoms :-

* dry cough
* cough with sputum, light, yellow is color
* cough with sputum, heavy, green is color
* sever cough
* light cough
* wheezes during the breathing
* flushing face

EXPERT SYSTEM IN INTERNAL DISEASES
THE RESPIRATORY SYSTEM
DIAGNOSIS OF DISEASES

determine the type of cough?

* dry cough
* cough with sputum, light, white is color
* cough with sputum, light, yellow is color
* cough with sputum, heavy, green is color
* why?
EXPERT SYSTEM IN INTERNAL DISEASES
THE RESPIRATORY SYSTEM
(CAUSES & TREATMENT)

treatment of 'asthma'
* gave oxygen
* corticosteroid
* aminophyllin
* bronchodilator