Hepatitis Expert System Diagnosis Using Sl5 Object

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Abstract: Background: Your liver is your body's largest solid organ. This organ is vital to the body's metabolic functions and immune system. Without a functioning liver, a person cannot survive. The liver's position is mostly in the right upper portion of the stomach, just below the diaphragm. A portion of the liver goes into the left upper abdomen as well. There are many types of diseases that can affect the liver and its functions. Objectives: The main objective of this expert system is to assist doctors in detecting Hepatitis diseases. Methods: In this paper we will implement an expert system using SL5 Object programming language so that it diagnoses the patient's condition and provides the appropriate solution. Results: This program was evaluated and tested by a group of doctors and patients with liver problems and they were satisfied with its performance. Conclusions: The Proposed expert system is very useful for doctors; to diagnosing liver diseases and treatment it whenever possible is given.

Keywords: Expert Systems, SL5 Object, Hepatitis, Diagnosis

1. INTRODUCTION

The liver is a half-moon shaped organ that's fairly straight on the bottom. It's tilted slightly in the body's cavity, with the left portion above the stomach and the right portion above the first part of the small intestine. The liver has two main portions, or lobes. Each lobe is further divided into eight segments. Each segment has an estimated 1,000 lobules, or small lobes. Each of these lobules has a small tube (duct) that flows toward the common hepatic duct. Compared to the rest of the body, the liver has a significant amount of blood flowing through it an estimated 13 percent of the body's blood is in the liver at any given time[1].
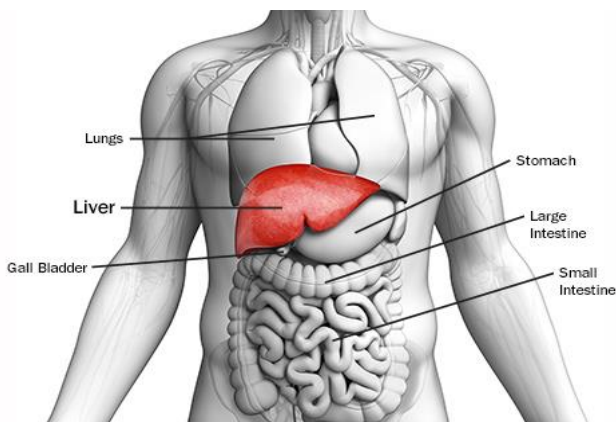

Figure 1: The figure shows liver

The liver's major functions are in the metabolic processes of the body. These include:
1. breaking down or converting substances
2. extracting energy
3. making toxins less harmful to the body and removing them from the bloodstream

The liver does this by receiving blood with nutrients from the digestive organs via a vein known as the portal vein.
The many cells of the liver, known as hepatocytes, accept and filter this blood. They act as little sorting centers, determining:
1. which nutrients should be processed
2. what should be stored
3. what should be eliminated via the stool
4. what should go back to the blood

The liver stores vitamins as well as minerals such as copper and iron, releasing them if the body needs them. The liver also helps to break down fats in a person's diet. It either stores fats or releases them as energy.
It also manufactures an estimated 800 to 1,000 milliliters of bile a day. This bile is transported via a bile duct to the small intestine. The small intestine uses the bile to further break down fats. Any extra bile is stored in the gallbladder.
The liver breaks down proteins as well. The by-product of this process is called ammonia, which can be toxic to the body in large amounts. The liver turns the toxic ammonia into a substance called urea. The liver releases this into the blood where the kidneys excrete it via the urine.
The liver also breaks down alcohol in the blood as well as many medications you take.
As if these functions weren't enough, the liver also plays major roles in the following:
1. creating immune system factors that can fight against infection
2. creating proteins responsible for blood clotting
3. breaking down old and damaged red blood cells
4. storing extra blood sugar as glycogen [1]

2. BACKGROUND/ LITERATURE REVIEW

Here is a summary of expert systems found in the literature:

- Detecting Health Problems Related to Addiction of Video Game Playing Using an Expert System [38] to assist users in getting the correct diagnosis of the health problem of video game addictions that range from (Musculoskeletal issues, Vision problems and Obesity). Furthermore, this expert system delivers information about the problem and tells us how we can solve it.

- Ear Diseases Diagnosis Expert System Using SL5 Object [32] swiftly diagnoses patient's condition and proposes a appropriate answer for the problem.

- Expert System for Chest Pain in Infants and Children [51] to assist doctors, parents, and care giver in diagnosing chest pain in infants and children.

- Expert System for Hair Loss Diagnosis and Treatment [63] for diagnosing eleven diverse hair loss diseases of the human stages from childhood to adults by asking questions with a Yes or No answer.

- Expert System for Problems of Teeth and Gums [38] assist people with teeth and gums problems to diagnose their problems and receive a recommendation for the treatment. This knowledge based system was developed using SL5 Object language.

- Expert system urination problems diagnosis [62] can diagnose some of the Urination diseases (Pyelonephritis, Kidney Stone, Bladder infection, Prostatitis, Urethritis, Gonorrhea, Interstitial cystitis, Stress incontinence, Trauma in kidney or bladder).

- Knowledge Based System for Ankle Diseases Diagnosis [44] recognized seven ankle diseases: Ankle Sprain, Fracture (of Fibula), Rheumatoid Arthritis, Rheumatoid Fever, Gout, and Osteoarthritis (Degenerative Joint) and they developed the expert system for those ankle diseases using SL5 Object Expert System Language.

- A Knowledge Based System for Neck Pain Diagnosis [46] can diagnose seven neck diseases of different phases of the human life beginning by asking the user many questions according to their pain symptoms.

- A Proposed Expert System for Foot Diseases Diagnosis [60] diagnoses eighteen foot problems of all phases of the human life beginning with baby to the grownup by examining with yes/no questions.

- A Proposed Expert System for Skin Diseases Diagnosis [64] was developed using CLIPS(C Language Integrated Production System) to help user diagnose the following skin diseases (Psoriasis, Eczema, Ichthyosis, Acne, Meningitis, Measles, Scarlet Fever, Warts, Insect Bites and Stings).

- A Proposed Rule Based System for Breasts Cancer Diagnosis [50] was developed to help people in preventing and early detecting breast cancer; since it is known that this disease does not have medication or cure yet.

- A Ruled Based System for Ear Problem Diagnosis and Treatment [48] was used to classify ear problems into three main sets: a- Inflammation of the inner ear b- Middle ear problems c- External ear problems.

- An expert system for diagnosing eye diseases using clips [34] provides the patient with background for suitable diagnosis of a few of the eye diseases.

- An Expert System for Diagnosing Shortness of Breath in Infants and Children [35] for diagnosing infants and children patients with twelve various shortness of breath in infants and children diseases.

- An Expert System for Endocrine Diagnosis and treatments using JESS [66] was developed to help in diagnosing endocrine glands diseases.

- An expert system for feeding problems in infants and children [36] to diagnose feeding problems in infants and children.

- An Expert System for Genital Problems in Infants [52] diagnoses genital problems in infants which is one of the most common problems that need quick intervention in the newly born stage.

- An expert system for men genital problems diagnosis and treatment [45] to assist men diagnose their genital problems and give them the suitable treatment. Genital problems and injuries usually occur through: recreational activities (such as: Basketball, Football, Hooky, Biking), work-related tasks (such as: contact to irritating chemicals), downhill drop, and sexual activities. SL5 Object expert system language was used to develop this expert system.

- An Expert System for Mouth Problems in Infants and Children [46] ask the user to answer the questions about the symptoms of the patient and end up with some information about the disease and some advices telling the user how to deal with the baby.

- An expert system for nausea and vomiting problems in infants and children[54] to aid users in getting the right diagnosis of problems of nausea and vomiting in infants and children (Gastro-esophageal reflux, Gastroenteritis, Systemic Infection, Bowel obstruction, Tumors, A bleeding disease, tonsillitis, and Hepatitis pharynx). Additionally, this expert system offers information about the disease and how to deal with it.

- An expert system for shoulder problems using CLIPS [58] can help in diagnosing shoulder problems.

- Knowledge Based System for Long-term Abdominal Pain (Stomach Pain) Diagnosis and Treatment [57] was made to aid internist physicians in diagnosing numerous of the abdomen diseases for example: gastritis, hiatal hernia, ulcer or heartburn; the proposed expert system offers a summary about abdomen diseases are given, the cause of diseases are drew and the cure of disease when possible is shown up.
- Knowledge Management in ESMDA: Expert System for Medical Diagnostic Assistance [37] deals with the design of a prototype expert system that assists patients to diagnose their diseases and offer them the suitable advice.
- Lower Back Pain Expert System Diagnosis and Treatment [41] can be used to positively diagnose low back pain concentration.
- Male Infertility Expert System Diagnoses and Treatment [423 for male infertility diagnosis which helps men to explore everything related to the problems of infertility and infertility diseases such as: Azoospermia, O.T.A syndrome which mean oligo-terato-astheno spermia, Aspermia and Sexual transmitted disease.
- Polymyalgia Rheumatic Expert System [65] outlined an expert system for classification criteria for PMR, recent advances of diagnostic and therapeutic procedures.
- Rickets Expert System Diagnoses and Treatment [40] assist doctors to discover everything connected to the problems of rickets.

Even though, there are many expert systems that are developed for diagnosing human problems; there is no specialized expert system for diagnosing Hepatitis diseases available free. The proposed expert system was designed and developed specifically to aid doctors in diagnosing Hepatitis diseases.

3. MATERIALS AND METHODS

There are many types of diseases that can affect the liver and its functions. Some have successful treatments while others do not. Examples of common conditions that affect the liver include: Hepatitis A, Hepatitis B Hepatitis C.
For all the above mentioned reasons, we have developed this expert system to assist doctors in diagnosing liver in order to recommend the appropriate treatment.
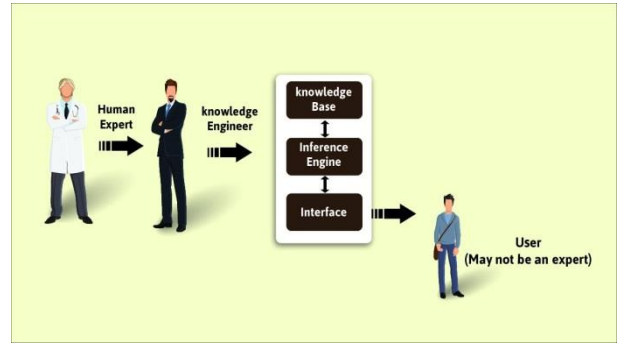

Figure 2: The figure shows components of expert system [6]

Expert Systems: An Expert System is a computer application of Artificial Intelligence (AI) [5]; which contains a user interface, explanation subsystem, a knowledge base and an inference engine; the main component of an expert system is clearly shown in figure 2.

The main proposed of this expert system is to assist doctors in detecting liver diseases by asking the end user questions that requires True or False answer.
The proposed expert system will ask the user to choose the correct answer in each screen. At the end of the expert system session, the diagnostics expert provides the user with identification of the problem, as well as provides him/her the advice or the recommendation for dealing with the problem.
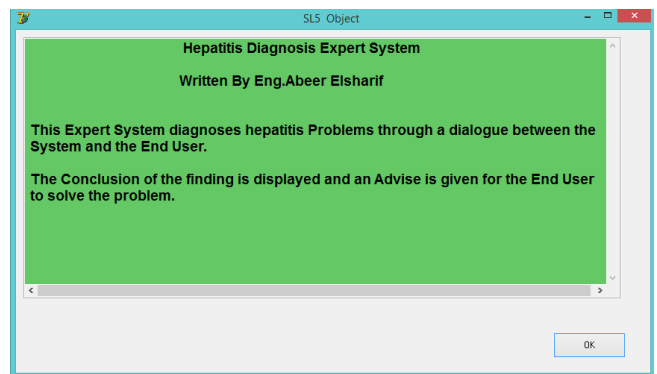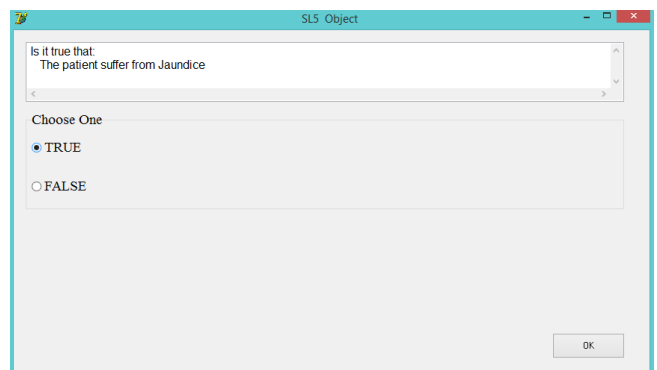

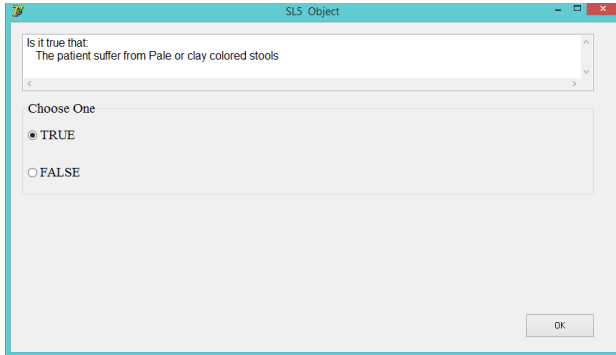Figure 3: The figure presents the main screen of expert system.

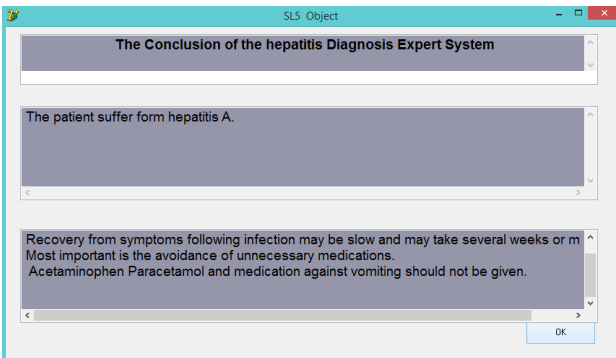Figure 4: The figures Shows when the system asks users.

Figure 5: The figure Shows when the system provides diagnosis and recommendation

4. KNOWLEDGE REPRESENTATION

There are many types of diseases that can affect the liver and its functions. Some have successful treatments while others do not. Examples of common conditions that affect the liver include:

Hepatitis: Viral hepatitis refers to a viral infection that causes liver inflammation. The hepatitis types have different letters, including A, B and C. Each has different causes and severity.

Hepatitis A is more common in developing countries that lack clean drinking water and have poor sanitation systems. Most people can recover from hepatitis A without liver failure or long-term complications.[1]

Hepatitis B can cause a short-or long-term infection. In U.S. adults, the disease is most commonly spread through sexual contact. However, a person can also get it through sharing needles or accidentally injecting themselves with a contaminated needle. The condition can cause serious complications, including liver failure and cancer. There's a vaccination against the disease to prevent it.[1]

Hepatitis C can be an acute or chronic infection. It's most commonly spread by coming in contact with blood containing the hepatitis C virus, such as through sharing unclean needles to inject drugs or apply tattoos. Less commonly, unprotected sexual contact with an infected person can transmit the infection, too. This condition can

cause inflammation that can lead to cirrhosis, liver failure, and liver cancer. [1]

The most common symptoms of hepatitis include:

- Dark urine (hepatitis A, B, C)
- Stomach pain (hepatitis B, C)
- Yellow skin or eye whites, called jaundice (hepatitis A, B, C)
- Pale or clay-colored stool (hepatitis A, C)
- Low-grade fever (hepatitis A, B, C)
- Loss of appetite (hepatitis A, B, C)
- Fatigue (hepatitis A, B, C)
- Feeling sick to your stomach (hepatitis A, B, C)
- Aching joints (hepatitis B).[7]

5. SYSTEM EVALUATION

Many doctors and specialists used and assessed the expert system and found that the expert system is easy to use, very useful, saves time and effort in diagnosing liver diseases

How to keep your liver healthy

These lifestyle changes can help you keep your liver healthy:
1. Get vaccinated for hepatitis A and hepatitis B.
2. Practice safe sex with a condom.
3. Don't share needles or personal care items.
4. Exercise regularly.
5. Talk to your doctor about any medications you're taking as they may affect your liver.
6. Limit the amount of alcohol you consume since it takes a lot for your liver to breakdown the toxins from alcohol maintain a healthy diet with fiber and fatty fishes[1]

6. CONCLUSION AND FUTURE WORK

The accurate diagnosis of the disease is one of the most important factors for the successful treatment of the patient quickly to alleviate the patient's pain so we propose this expert system for the treatment of diagnosis and treatment of liver diseases through a series of questions so that the expert system instructions to deal with the disease.

In the near future, we will add more knowledge to the expert system so it can cover more diseases of the liver problems.

7. EXPERT SYSTEM SOURCE CODE

```
!Written by Eng.Abeer Elsharif
!

ATTRIBUTE start SIMPLE

ATTRIBUTE The patient suffer from Jaundice SIMPLE

ATTRIBUTE The patient suffer from Fatigue SIMPLE
```

ATTRIBUTE The patient suffer from Loss of appetite
SIMPLE

ATTRIBUTE The patient suffer from Nausea and vomiting
SIMPLE

ATTRIBUTE The patient suffer from Low grade fever
SIMPLE

ATTRIBUTE The patient suffer from Dark urine SIMPLE

ATTRIBUTE Stage1 SIMPLE

ATTRIBUTE The patient suffer from Pale or clay colored
stools SIMPLE

ATTRIBUTE The patient suffer from stomach pain SIMPLE

ATTRIBUTE The patient suffer from aching joint SIMPLE

INSTANCE the domain ISA domain
  WITH start := TRUE
  WITH Stage1 := FALSE

INSTANCE the application ISA application
 WITH title display := introduction
 WITH conclusion display := Conc

INSTANCE introduction ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1] := textbox 1

INSTANCE textbox 1 ISA textbox
  WITH location := 10,10,800,350
  WITH pen color := 0,0,0
  WITH fill color := 100,200,100
  WITH justify IS left
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
  WITH text "=:

           Hepatitis Diagnosis Expert System

           Written By Eng.Abeer Elsharif

This Expert System diagnoses hepatitis Problems through a
dialogue between the
System and the End User .

The Conclusion of the finding is displayed and an Advise is
given for the End User
to solve the problem".

INSTANCE Conc ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1] := title textbox
  WITH items [2] := problem textbox
  WITH items [3] := advise textbox

INSTANCE title textbox ISA textbox
  WITH location := 20,10,800,70
  WITH pen color := 0,0,0
  WITH fill color := 150,150,170
  WITH justify IS center
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
  WITH text := " The Conclusion of the hepatitis Diagnosis
Expert System"

INSTANCE problem textbox ISA textbox
  WITH location := 20,110,800,130
  WITH pen color := 0,0,0
  WITH fill color := 150,150,170
  WITH justify IS left
  WITH font := "Arial"
  WITH font size := 14
  WITH text"--===-- "=:

INSTANCE advise textbox ISA textbox
  WITH location := 20,280,800,130
  WITH pen color := 0,0,0
  WITH fill color := 150,150,170
  WITH justify IS left
  WITH font := "Arial"
  WITH font size := 14
  WITH text"--===-- "=:

RULE R0
IF start
THEN ASK The patient suffer from Jaundice

RULE R1
IF The patient suffer from Jaundice
THEN ASK The patient suffer from Fatigue

RULE R2
IF The patient suffer from Jaundice
AND The patient suffer from Fatigue
THEN ASK The patient suffer from Loss of appetite

RULE R3
IF The patient suffer from Jaundice
AND The patient suffer from Fatigue
AND The patient suffer from Loss of appetite
THEN ASK The patient suffer from Nausea and vomiting

RULE R4

IF The patient suffer from Jaundice
AND The patient suffer from Fatigue
AND The patient suffer from Loss of appetite
AND The patient suffer from Nausea and vomiting
THEN ASK The patient suffer from Low grade fever

RULE R5
IF The patient suffer from Jaundice
AND The patient suffer from Fatigue
AND The patient suffer from Loss of appetite
AND The patient suffer from Nausea and vomiting
AND The patient suffer from Low grade fever
THEN ASK The patient suffer from Dark urine

RULE R6
IF The patient suffer from Jaundice
AND The patient suffer from Fatigue
AND The patient suffer from Loss of appetite
AND The patient suffer from Nausea and vomiting
AND The patient suffer from Low grade fever
AND The patient suffer from Dark urine
THEN Stage1 := TRUE

RULE R7
IF Stage1
THEN ASK The patient suffer from Pale or clay colored stools
AND ASK The patient suffer from stomach pain
AND ASK The patient suffer from aching joint

RULE R8
IF Stage1
AND The patient suffer from Pale or clay colored stools
AND NOT The patient suffer from stomach pain
AND NOT The patient suffer from aching joint
THEN text OF problem textbox := "The patient suffer form hepatitis A".
AND text OF advise textbox := "The Advice: There is no specific treatment for hepatitis A .
Recovery from symptoms following infection may be slow and may take several weeks or months .
Most important is the avoidance of unnecessary medications.
 Acetaminophen Paracetamol and medication against vomiting should not be given".

RULE R11
IF Stage1
AND NOT The patient suffer from Pale or clay colored stools
AND The patient suffer from stomach pain
AND The patient suffer from aching joint
THEN text OF problem textbox := "The patient suffer form hepatitis B".
AND text OF advise textbox := "The Advice: Go to your doctor for the treatment CF 100%"

RULE R22
IF Stage1
AND The patient suffer from Pale or clay colored stools
AND The patient suffer from stomach pain
AND NOT The patient suffer from aching joint
THEN text OF problem textbox := "The patient suffer form hepatitis C".
AND text OF advise textbox := "The Advice: Go to your doctor for the treatment CF 100%"

END

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