Kidney Expert System Diseases and Symptoms

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Abstract: *Kidneys are an important part of the human body, both sides of the spine and above the waist. The lower ribs protect the kidneys. In the kidneys there are filtration units which are tiny units and the functions of the kidney where the excess fluid and dissolved particles are filtered and converted to urine, purification and cleaning of blood, balancing the fluids contained in the body, production of the renin enzyme, which helps control blood pressure and adjust the level Salts and other chemicals to keep the body functioning properly. In this research, we developed an expert system capable of identifying the disease that affects the kidney by identifying the symptoms that appear from the list of symptoms that appear to the doctor to avoid the user typing the symptoms wrongly. The expert system was developed using SL5 Object language and has been experimented by doctors and has given satisfactory results.*

Keywords: Expert system, Kidney, Diseases

1. INTRODUCTION

A program that help in creating more than ITS with relatively easy way and provide the experience of crating ITS without the need of expert programmer to made it.

The kidneys are two bean-shaped organs, each about the size of a fist. They are located just below the rib cage, one on each side of your spine.
Healthy kidneys filter about a half cup of blood every minute, removing wastes and extra water to make urine. The urine flows from the kidneys to the bladder through two thin tubes of muscle called ureters, one on each side of your bladder. Your bladder stores urine. Your kidneys, ureters, and bladder are part of your urinary tract.
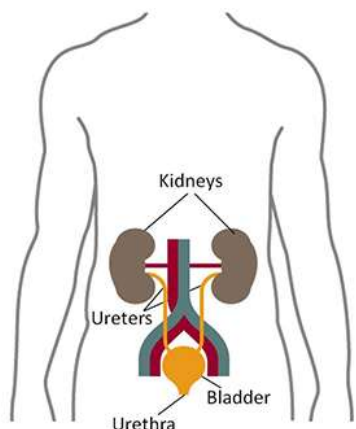

Figure 1: The figure shows kidneys

Your kidneys remove wastes and extra fluid from your body. Your kidneys also remove acid that is produced by the cells of your body and maintain a healthy balance of water, salts, and minerals such as sodium, calcium, phosphorus, and potassium in your blood.
Without this balance, nerves, muscles, and other tissues in your body may not work normally.

2. ARCHITECTURE OF EXPERT SYSTEM

Expert Systems, also known as Knowledge-based Systems, Intelligent Agent Systems, or more generally as Knowledge Systems, are computer programs that exhibit a similar high level of intelligent performance as human experts. An expert system generally consists of four components: a knowledge base, the search or inference system, a knowledge acquisition system, and the user interface or communication system.
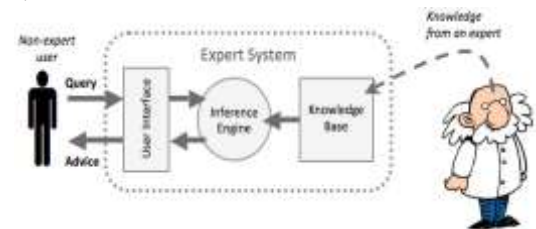

Figure 2: The figure shows Expert System component

nowledge systems solve difficult problems of the real world by performing inference processes on explicitly stated knowledge. The early rule-based systems of the 1970s, the subsequent model-based approaches of the late 1980s, and the newest knowledge systems with common sense, evolutionary knowledge growth and multiagency define three different generations of expert systems. Together these systems test one of the main hypothesis of the cognitive revolution of the sciences, namely that by virtue of being a physical symbol system, knowledge systems have the necessary and sufficient means for general intelligent action. There are several successful applications of knowledge

systems in industry, business, medicine and science, as for example knowledge management systems and various components of e-commerce systems.

In expert systems, there are two another major components: inference engine and knowledge base. The inference engine generates interpretations using the knowledge base. Rules are used as the representation for knowledge in the knowledge base and the interpretations by the inference engine are diagnoses, classifications or conclusions. High quality rules within the knowledge base are built by domain experts using the knowledge acquisition method. This method is the key to the success of expert systems as they are bound to the quality of acquired knowledge. However, knowledge acquisition is a difficult process within expert systems because domain experts usually provide incomplete, even incorrect, knowledge as they are unable to articulate it. This is called 'knowledge acquisition bottleneck'.

3. MATERIALS AND METHODS

The purpose of this system shown in Figure 3, is to identify the disease by answering the questions presented to the user as shown in Figure 4.
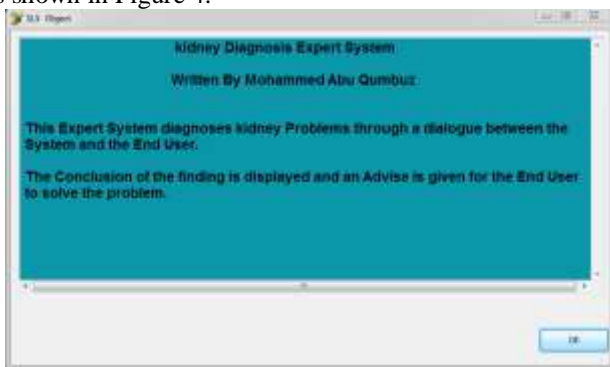

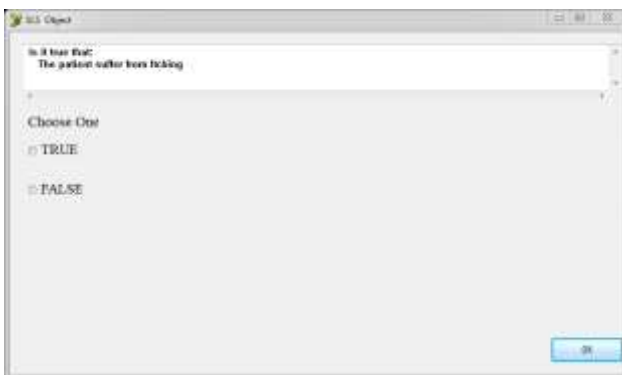Figure 3: The figure shows kidney expert system

Figure 4: The figure shows a sample dialogue between the expert system and the user.

After analyzing the symptoms by the expert system, the result of the analysis is presented in Figure 5, showing the name of the disease and the procedure for treating the disease
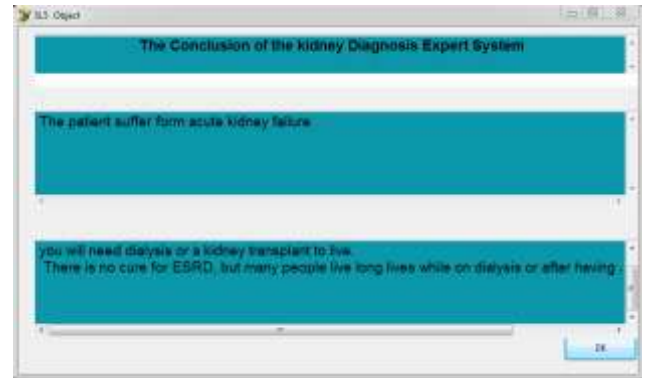

Figure 5: The figure shows how the users get the diagnosis and recommendation

4. LITERATURE REVIEW

Nowadays, there is a lot of knowledge-based system that treats a special problem or manages a certain domain; However, There is a lot of Expert System that were designed to diagnose human diseases such as:

- Knowledge Based System for Long-term Abdominal Pain (Stomach Pain) Diagnosis and Treatment [62] 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 Based System for Ankle Diseases Diagnosis [49] 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.

- An Expert System for Diagnosing Shortness of Breath in Infants and Children [40] for diagnosing infants and children patients with twelve various shortness of breath in infants and children diseases.

- Polymyalgia Rheumatic Expert System [7] outlined an expert system for classification criteria for PMR, recent advances of diagnostic and therapeutic procedures.

- Expert System for Chest Pain in Infants and Children [56] to assist doctors, parents, and care giver in diagnosing chest pain in infants and children.

- Rickets Expert System Diagnoses and Treatment [45] assist doctors to discover everything connected to the problems of rickets.

- Expert System for Hair Loss Diagnosis and Treatment [68] 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 [42] 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.
- Ear Diseases Diagnosis Expert System Using SL5 Object [38] swiftly diagnoses patient's condition and proposes a appropriate answer for the problem.
- An expert system for feeding problems in infants and children [41] to diagnose feeding problems in infants and children.
- Detecting Health Problems Related to Addiction of Video Game Playing Using an Expert System [44] 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.
- An expert system for men genital problems diagnosis and treatment [50] 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 Genital Problems in Infants [57] 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 nausea and vomiting problems in infants and children[60] 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.
- A Ruled Based System for Ear Problem Diagnosis and Treatment [53] was used to classify ear problems into three main sets: a- Inflammation of the inner ear b- Middle ear problems c- External ear problems.
- Lower Back Pain Expert System Diagnosis and Treatment [46] can be used to positively diagnose low back pain concentration.
- A Proposed Expert System for Foot Diseases Diagnosis [56] diagnoses eighteen foot problems of

all phases of the human life beginning with baby to the grownup by examining with yes/no questions.

- A Knowledge Based System for Neck Pain Diagnosis [52] can diagnose seven neck diseases of different phases of the human life beginning by asking the user many questions according to their pain symptoms.
- An expert system for shoulder problems using CLIPS [63] can help in diagnosing shoulder problems.
- Expert system urination problems diagnosis [67] can diagnose some of the Urination diseases (Pyelonephritis, Kidney Stone, Bladder infection, Prostatitis, Urethritis, Gonorrhea, Interstitial cystitis, Stress incontinence, Trauma in kidney or bladder).
- A Proposed Rule Based System for Breasts Cancer Diagnosis [55] 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 Proposed Expert System for Skin Diseases Diagnosis [69] 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).
- Male Infertility Expert System Diagnoses and Treatment [48] 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.
- An Expert System for Mouth Problems in Infants and Children [61] 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.
- Knowledge Management in ESMDA: Expert System for Medical Diagnostic Assistance [11] deals with the design of a prototype expert system that assists patients to diagnose their diseases and offer them the suitable advice.
- Expert System for the Diagnosis of Seventh Nerve Inflammation (Bell's palsy) Disease [12] diagnosis the seven nerve inflammation which will help doctors to explore everything related to the problems of seventh nerve inflammation. We look forward to providing simplified answers to seven nerve inflammation.
- Knowledge Based System for the Diagnosis of Dengue Disease [10] to help doctors and patients in diagnosing Dengue Disease and give them the

information of how to prevent Dengue Disease and to be able to understand the signs and symptoms of Dengue Disease.

- An Expert System for Arthritis Diseases Diagnosis Using SL5 Object[8] to help Orthopedist in diagnosing Arthritis disease through its symptoms such as: pain on pressure in a joint, Inflammation indicated by joint swelling, Stiffness.
- A Proposed Expert System for Diagnosing Skin Cancer Using SL5 Object [66] quickly diagnose patient's condition and propose a suitable solution for the problem.
- An Expert System for Depression Diagnosis [13] to get the appropriate diagnosis of disease and the correct treatment and give the appropriate method of treatment through several tips that concern the disease and how to treat it.
- Knowledge Based System for Diabetes Diagnosis Using SL5 Object [51] to get the appropriate diagnosis of the illness, dealing with it quickly, and tips for permanent treatment whenever possible is given out.
- Hepatitis Expert System Diagnosis Using Sl5 Object [36] diagnoses the patient's condition and provides the appropriate solution.

But there is no specialized expert system for the diagnosis of kidney disease available free and use SL5 Object language. This expert system is easy to use by doctors and patients. This is due to the coordinated application interface.

5. KNOWLEDGE REPRESENTATION

In most cases, kidney failure is caused by other health problems that have done permanent damage (harm) to your kidneys little by little, over time.

When your kidneys are damaged, they may not work as well as they should. If the damage to your kidneys continues to get worse and your kidneys are less and less able to do their job, you have chronic kidney disease. Kidney failure is the last (most severe) stage of chronic kidney disease. This is why kidney failure is also called end-stage renal disease, or ESRD for short.

Diabetes is the most common cause of ESRD. High blood pressure is the second most common cause of ESRD.

Other problems that can cause kidney failure include:

Autoimmune diseases, such as lupus and IgA nephropathy
Genetic diseases (diseases you are born with), such as polycystic kidney disease
Nephrotic syndrome
Urinary tract problems
Sometimes the kidneys can stop working very suddenly (within two days). This type of kidney failure is called acute kidney injury or acute renal failure.

Common causes of acute renal failure include:
Heart attack

Illegal drug use and drug abuse
Not enough blood flowing to the kidneys
Urinary tract problems
This type of kidney failure is not always permanent. Your kidneys may go back to normal or almost normal with treatment and if you do not have other serious health problems.

Having one of the health problems that can lead to kidney failure does not mean that you will definitely have kidney failure. Living a healthy lifestyle and working with your doctor to control these health problems can help your kidneys work for as long as possible.

You may notice one or more of the following symptoms if your kidneys are beginning to fail:

- Itching
- Muscle cramps
- Nausea and vomiting
- Not feeling hungry
- Swelling in your feet and ankles
- Too much urine (pee) or not enough urine
- Trouble catching your breath
- Trouble sleeping

Acute kidney failure

Acute kidney failure occurs when your kidneys suddenly become unable to filter waste products from your blood. When your kidneys lose their filtering ability, dangerous levels of wastes may accumulate, and your blood's chemical makeup may get out of balance.

Acute kidney failure also called acute renal failure or acute kidney injury develops rapidly, usually in less than a few days. Acute kidney failure is most common in people who are already hospitalized, particularly in critically ill people who need intensive care.

Acute kidney failure can be fatal and requires intensive treatment. However, acute kidney failure may be reversible. If you're otherwise in good health, you may recover normal or nearly normal kidney function.

Signs and symptoms of acute kidney failure may include:

- Decreased urine output, although occasionally urine output remains normal
- Fluid retention, causing swelling in your legs, ankles or feet
- Shortness of breath
- Fatigue
- Confusion
- Nausea
- Weakness
- Irregular heartbeat
- Chest pain or pressure
- Seizures or coma in severe cases

Sometimes acute kidney failure causes no signs or symptoms and is detected through lab tests done for another reason.

6. LIMITATION

The current expert system suffers from several obstacles and diagnoses only two diseases. It is possible that these two diseases share the same symptoms, so it is necessary to identify all the signs to accurately identify the disease

7. SYSTEM EVALUATION

This system offers an expert user interface and easy to use and after experimenting by me and a group of doctors in the trial of some of the symptoms we found that the system gives satisfactory results and doctors did not find it difficult to use the program because they can choose the symptoms from the list of symptoms without having to write.

8. CONCLUSION

In this paper, we have introduced an expert system that helps doctors to detect kidney diseases by encountering a simple user showing the list of symptoms. The doctor should choose the symptoms that appear on the kidney and then the system will analyze these symptoms and show the disease corresponding to those diseases based on the rules of the program Using SL5 language.

9. FUTURE WORKS

In the future, I seek to develop an expert system that can identify kidney disease by taking a picture of the kidney without having to write or choose the symptoms, analyze the image and learn about all kidney diseases.

10. SOURCE CODE

```
! Written by Eng. Mohammed Naji Abu Al-Qumbuz
ATTRIBUTE start SIMPLE
ATTRIBUTE The patient suffer from Itching SIMPLE
ATTRIBUTE The patient suffer from Muscle cramps SIMPLE
ATTRIBUTE The patient suffer from Nausea and vomiting SIMPLE
ATTRIBUTE The patient suffer from Not feeling hungry SIMPLE
ATTRIBUTE The patient suffer from Swelling in your feet and ankles SIMPLE
ATTRIBUTE The patient suffer from Too much urine pee or not enough urine SIMPLE
ATTRIBUTE The patient suffer from Trouble catching your breath SIMPLE
ATTRIBUTE The patient suffer from Trouble sleeping SIMPLE
ATTRIBUTE The patient suffer from Abdominal belly pain SIMPLE
ATTRIBUTE The patient suffer from Back pain SIMPLE
ATTRIBUTE The patient suffer from Diarrhea SIMPLE
ATTRIBUTE The patient suffer from Fever SIMPLE
ATTRIBUTE The patient suffer from Nosebleeds SIMPLE
ATTRIBUTE The patient suffer from Rash SIMPLE
ATTRIBUTE The patient suffer from Vomiting SIMPLE

INSTANCE the domain ISA domain
   WITH start := TRUE

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 := 12,150,170
   WITH justify IS left
   WITH font := "Arial"
   WITH font style IS bold
   WITH font size := 14
   WITH text :="
                        Kidney Diagnosis Expert System
                         Written By Mohammed Abu Al-
Qumbuz
This Expert System diagnoses kidney 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 := 12,150,170

WITH justify IS center

WITH font := "Arial"

WITH font style IS bold

WITH font size := 14

WITH text := " The Conclusion of the kidney Diagnosis Expert System"

INSTANCE problem textbox ISA textbox

  WITH location := 20,110,800,130

  WITH pen color := 0,0,0

  WITH fill color := 12,150,170

  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 := 12,150,170

  WITH justify IS left

  WITH font := "Arial"

  WITH font size := 14

  WITH text :=" --===--"

RULE R0
IF start
THEN ASK The patient suffer from Itching

RULE R1
IF The patient suffer from Itching
THEN ASK The patient suffer from Muscle cramps

RULE R2
IF The patient suffer from Itching
AND The patient suffer from Muscle cramps
THEN ASK The patient suffer from Nausea and vomiting

RULE R3
IF The patient suffer from Itching
AND The patient suffer from Muscle cramps
AND The patient suffer from Nausea and vomiting
THEN ASK The patient suffer from Not feeling hungry

RULE R4
IF The patient suffer from Itching
AND The patient suffer from Muscle cramps
AND The patient suffer from Nausea and vomiting
AND The patient suffer from Not feeling hungry
THEN ASK The patient suffer from Swelling in your feet and ankles

RULE R5
IF The patient suffer from Itching
AND The patient suffer from Muscle cramps
AND The patient suffer from Nausea and vomiting
AND The patient suffer from Not feeling hungry
AND The patient suffer from Swelling in your feet and ankles
THEN ASK The patient suffer from Too much urine pee or not enough urine

RULE R6
IF The patient suffer from Itching
AND The patient suffer from Muscle cramps
AND The patient suffer from Nausea and vomiting
AND The patient suffer from Not feeling hungry
AND The patient suffer from Swelling in your feet and ankles
AND The patient suffer from Too much urine pee or not enough urine
THEN ASK The patient suffer from Trouble catching your breath

RULE R7
IF The patient suffer from Itching
AND The patient suffer from Muscle cramps
AND The patient suffer from Nausea and vomiting
AND The patient suffer from Not feeling hungry
AND The patient suffer from Swelling in your feet and ankles
AND The patient suffer from Too much urine pee or not enough urine
AND The patient suffer from Trouble catching your breath
THEN ASK The patient suffer from Trouble sleeping

RULE R8
IF The patient suffer from Itching
AND The patient suffer from Muscle cramps

AND The patient suffer from Nausea and vomiting

AND The patient suffer from Not feeling hungry

AND The patient suffer from Swelling in your feet and ankles

AND The patient suffer from Too much urine pee or not enough urine

AND The patient suffer from Trouble catching your breath

AND The patient suffer from Trouble sleeping

THEN text OF problem textbox := "The patient suffer form kidney "

AND text OF advise textbox := "The Advice: If detected early enough,

 the progress of kidney disease can be slowed and sometimes even prevented.

 In the early stages, changes to diet and medication can help to increase the life of your kidneys."

ELSE ASK The patient suffer from Abdominal belly pain

RULE R9

IF The patient suffer from Abdominal belly pain

THEN ASK The patient suffer from Back pain

RULE R10

IF The patient suffer from Abdominal belly pain

AND The patient suffer from Back pain

THEN ASK The patient suffer from Diarrhea

RULE R11

IF The patient suffer from Abdominal belly pain

AND The patient suffer from Back pain

AND The patient suffer from Diarrhea

THEN ASK The patient suffer from Fever

RULE R12

IF The patient suffer from Abdominal belly pain

AND The patient suffer from Back pain

AND The patient suffer from Diarrhea

AND The patient suffer from Fever

THEN ASK The patient suffer from Nosebleeds

RULE R13

IF The patient suffer from Abdominal belly pain

AND The patient suffer from Back pain

AND The patient suffer from Diarrhea

AND The patient suffer from Fever

AND The patient suffer from Nosebleeds

THEN ASK The patient suffer from Rash

RULE R14

IF The patient suffer from Abdominal belly pain

AND The patient suffer from Back pain

AND The patient suffer from Diarrhea

AND The patient suffer from Fever

AND The patient suffer from Nosebleeds

AND The patient suffer from Rash

THEN ASK The patient suffer from Vomiting

RULE R15

IF The patient suffer from Abdominal belly pain

AND The patient suffer from Back pain

AND The patient suffer from Diarrhea

AND The patient suffer from Fever

AND The patient suffer from Nosebleeds

AND The patient suffer from Rash

AND The patient suffer from Vomiting

THEN text OF problem textbox := "The patient suffer form acute kidney failure"

AND text OF advise textbox := "The Advice: If you have kidney failure (end-stage renal disease or ESRD),

you will need dialysis or a kidney transplant to live.

 There is no cure for ESRD, but many people live long lives while on dialysis or after having a kidney transplant.
"

END

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