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Expert System To Detect Digestive Disorders With Backward Chaining Method

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Abstract

Digestive disorders are various types of problems that occur in the body's digestive system, ranging from the mouth, esophagus, stomach, small intestine, large intestine, and anus. The digestive system functions to receive and digest food which is then converted into nutrients for the body to absorb. The absorbed nutrients will then be distributed throughout the body through the bloodstream. In addition, the digestive system is also tasked with separating and removing parts of food that are not needed and cannot be digested by the body. Digestive disorders that occur can be very difficult and should not be ignored. Many do not know that symptoms that are felt in the body are the result of certain digestive disorders, so it is often too late to be known and result in the need for a visit to the doctor. An Expert System is needed that can help the community in knowing the symptoms of the causes and prevention of digestive disorders in the body. Expert system to detect digestive disorders in this study uses backward chaining inference where the search process starts from the goal, which is the conclusion that becomes the solution to the problem at hand.

Keywords : Backward Chaining, Expert System, Digestive disorders

Introduction

Digestive disorders are various types of problems that occurin the body's digestive system, starting from the mouth, esophagus, stomach, small intestine, large intestine, and anus. Indigestion that occurs can be very difficult and should not be ignored.

The problem that currently often occurs is that there are still many ordinary people who do not understand and know the symptoms of this type of digestive disorder and are late in handling it. If digestive disorders occur, they will rely more on expert doctors regardless of whether the disorder is still in low level or chronic. For this reason, it is necessary to know the symptoms, causes and prevention of this type of digestive disorder, so that the disorders suffered do not have an impact and can be treated immediately. An expert system is needed that can help the community in knowing the symptoms, causes and prevention of this type of digestive disorder.

For this reason, the authors are interested in conducting expert system research to detect digestive disorders using the Backward Chaining method. The Expert System itself is designed to be web-based, because web-based applications can help the process of disseminating information and knowledge with a wider distribution area.

Indigestion

Indigestion is a disease that occurs due to tension in the human digestive system. The main cause of this digestive disorder usually occurs due to irregular and unhealthy eating patterns and stress,

bacterial infections, worms and can also be due to stomach disorders. Lots. Many diseases are associated with digestive disorders. Among them, such as diarrhea, appendicitis, gastritis, gastric ulcers, ulcers, and nausea (Ashari & Muniar, nd). Digestive disturbances can be associated with highly complex combinations of changes (nonlinear and interactive) on a subset of variables, which can be monitored.

METHOD

Expert system

An expert system is a system that is designed and implemented with the help of a particular programming language to be able to solve problems as done by experts (Dhani & Yamasari, 2014). The basic concept of an expert system contains several elements, namely: expertise / expertise, experts / experts, transfer of expertise / expertise, inference, rules and the ability to explain (Ulya, Regasari, & Furqon, 2016).

Backward Chaining

*Backward Chaining*is a tracking technique that starts from a set of conclusions, then the desired hypothesis, then by using the existing rules will search for a large number of initial conditions of facts that support these rules. Matching facts or statements starting from the right side (Syafrizal, Setyaningrum, & Hulliyah, 2015)

Expert System Components

An expert system has several main components, namely: user interface, expert system database, knowledge acquisition facility and inference mechanism. In addition, there is one component that exists in several expert systems, namely the explanation facility (Soepomo, 2012) (Puspitasari, 2011).

Research Stages

The following are the stages carried out in the research are as follows:

1. Identification of problems
   At this stage, the problem that will be the object of research is formulated. The formulation of the problem is carried out to determine what problems are contained in the object of research and provide boundaries for the problems to be studied. This step is the first step in this research.
2. Study of literature
   After identifying the problem, the literature related to the problem is studied. Then the literature studied is selected to determine which literature will be used in this study.
3. Building Knowledge Base
   The stage of building this knowledge base consists of 2 stages, namely the stage of knowledge acquisition and knowledge representation. Knowledge Acquisition is a process to gain knowledge about issues that will be discussed and used as a guide in development. After the data collection process is complete, the data is represented in a knowledge base and a rule base which is then coded, organized and described in the form of a decision tree so that it becomes a systematic form.
4. System Design
   At this stage, the researcher will design the system to be built first. This system design aims to create a clear and complete system design which will later be used for making computer programs.
5. System Implementation
   The system implementation stage is the system realization stage based on the design that has been made in the form of a computer program. This program will be used by the community to find out the symptoms and solutions for each type of digestive disorder.

6. Test Results
   At the stage of testing the results of the authors implement the model and the results of system design using the PHP programming language.

Approach Used

The approach taken by the researcher is to conduct interviews with Internal Medicine Specialists directly regarding the symptoms and solutions of each type of digestive disorder that is needed to create or design an expert system to detect digestive disorders.

Data Collection and Data Analysis Techniques

1. Literature Study, which is to collect and study previous studies and journals related to expert systems using the backward chaining method.
2. Observation, is useful for collecting data and observing directly with the parties involved in completing this research where information and needs will be obtained as material in making or designing an expert system to detect digestive disorders.

User Interface Design (User Interface)

In designing the user interface, this is the display framework of the Expert System application that will deal directly with the user. To facilitate the operation of this system, the program organization is designed as shown in Figure 1:

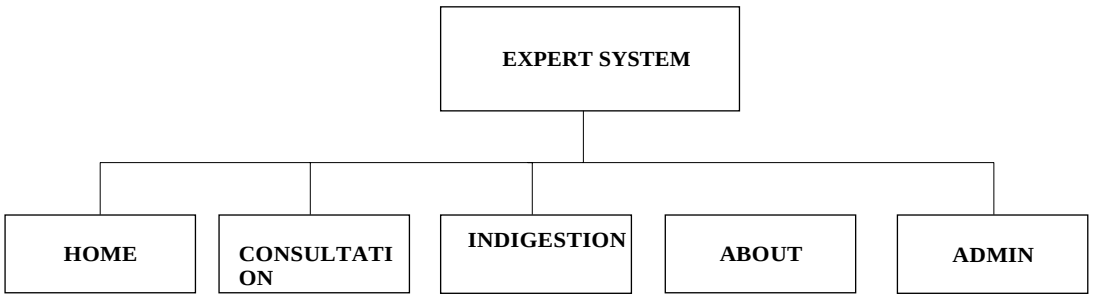

Figure 1: Program Organization

RESULTS AND DISCUSSION

The Expert System to detect digestive disorders begins by collecting data from an expert (an internal medicine specialist). Data collection is carried out by direct interviews with experts so that the data collected or the data obtained will be represented in the form of units of knowledge.

Building Knowledge Base

After getting the data and information needed in this expert system. The next step is to build a knowledge base. Where the knowledge base contains expert knowledge in the form of facts, concepts, rules, procedures, and relationships between them, which have been represented in a form that is understood by the system. The stage of building this knowledge base consists of the stages of knowledge acquisition and knowledge representation.

Knowledge Acquisition

Knowledge acquisition is the process of collecting information from available sources, which can be in the form of a person's expertise or latent expertise (stored in the form of printed material). In this study, data were obtained from interviews with internal medicine specialists regarding the types of digestive disorders and their symptoms.

Knowledge Representation

Knowledge representation is the next step in the knowledge acquisition process. After the

knowledge has been extracted from the expert, then what is done is to represent the forms of knowledge into a form that is recognized by the system (computer).

The following is data on the types of digestive disorders and their symptoms that have been coded, including:

Table 1. Knowledge Representation of Digestive Disorders

No.	Types of Digestive Disorder	ID Digestive Disorder
1	Diarrhea	GP01
2	Constipation	GP02
3	Hemorrhoids / Hemorrhoids	GP03
4	Gastritis	GP04
5	Appendicitis	GP05

Table 2. Knowledge Representation of Digestive Disorder Symptoms

No.	Sympt om	Symptom ID
1	Stomach feels bloated	GGP01
2	The frequency of defecation (BAB) more than 3 times per day with a watery stool texture and even bloody	GGP02
3	The feeling of wanting to defecate immediately	GGP03
4	Vomit	GGP04
5	Nauseous	GGP05
6	Stomach ache, or stomach discomfort	GGP06
7	Experiencing dehydration	GGP07
8	Dizziness, weakness, and dry skin	GGP08
9	Hard defecation	GGP09
10	Removing hard faeces	GGP10
11	Need to push hard to get rid of dirt	GGP11
12	Feeling that there is still dirt left after defecating	GGP12
13	Need additional movement to remove feces, such as pressing on the stomach or removing feces using finger	GGP13
14	Stomach ache	GGP14
15	Distended stomach	GGP15
16	Itching or pain around the anus	GGP16
17	Bleeding from the anusafter defecation	GGP17
18	Mucus discharge after defecation.	GGP18
19	A lump hanging outside the anus	GGP19
20	Pain that feels hot and stinging in the stomach in the solar plexus	GGP20
21	Bloated	GGP21
22	Hiccup	GGP22

Table 2. Knowledge Representation of Digestive Disorders Symptoms (Continued)

No.	Symptom	Symptom ID
23	Loss of appetite	GGP23
24	Quickly feel full when eating	GGP24

25	CHAPTER with dark black stools	GGP25
26	Vomiting blood	GGP26
27	Can't pass gas (fart)	GGP27
28	Constipationor diarrhea	GGP28
29	Fever	GGP29
30	Pain near the navel	GGP30
31	Pain when urinating	GGP31
32	Stomach cramps	GGP32

Based on the data obtained, the knowledge that has been obtained is represented in the form of a decision tree (decision tree). With the decision tree, the author can easily see and identify the relationship between the types of digestive disorders and their symptoms. From the symptoms of digestive disorders, we will be able to group the symptoms with the types of digestive disorders as shown in Figure 2 as follows:

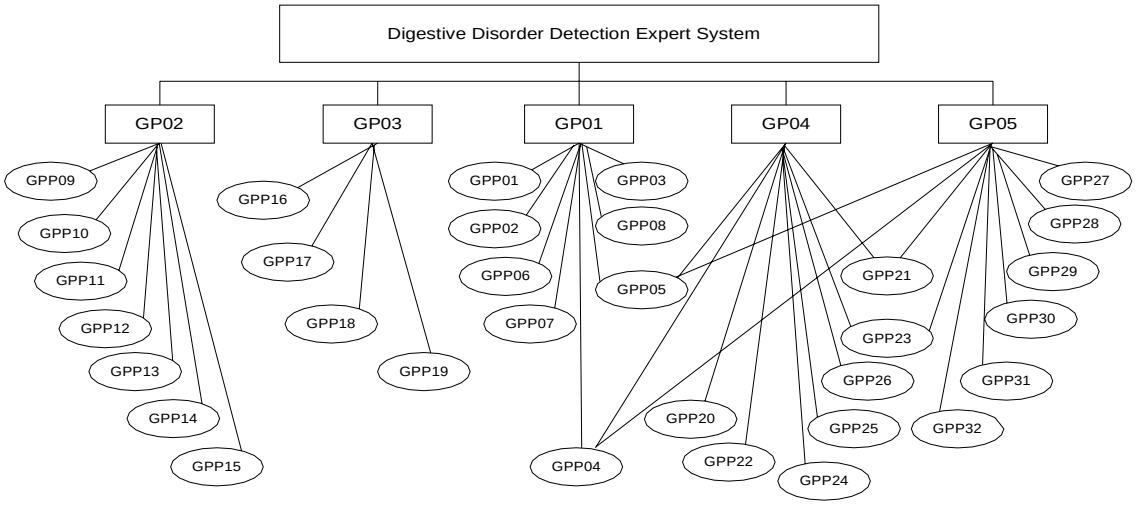

Figure 2. Decision Tree

Based on the results of the knowledge representation from the decision tree that has been made, the rules obtained from the Expert System application to detect digestive disorders are as shown in table 5 below:

Table 3. Digestive Disorder Rules with Symptoms

No.	IF	THEN
1	GGP01 is True AND GGP02 is True AND GGP03 is True AND GGP04 is True AND GGP05 is True AND GGP06 is True AND GGP07 is True AND GGP08 is True	GP01 is Diarrhea
2	GGP09 is True AND GGP10 is True AND GGP11 is True AND GGP12 is True AND GGP13 is True AND GGP14 is True AND GGP15 is True	GP02 is Constipation
3	GGP16 is True AND GGP17 is True AND GGP18 is True AND GGP19 is True	GP03 is Hemorrhoids / Hemorrhoids

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No.	IF	THEN
4	GGP04 is True AND GGP05 is True AND GGP20 is True AND GGP21 is True AND GGP22 is True AND GGP23 is True AND GGP24 is True GGP25 is True AND GGP26 is True	GP04 is Gastritis
5	GGP04 is True AND GGP05 is True AND GGP21 is True AND GGP23 is True AND GGP27 is True AND GGP28 is True AND GGP29 is True GGP30 is True AND GGP31 is ND GGP32 is True	GP05 is Appendicitis

Consultation Results Page View

On this page, the system will display the results of the consultation carried out by the user. The system will display the results in accordance with the input data made by the user. The consultation results page can be seen in the image below:

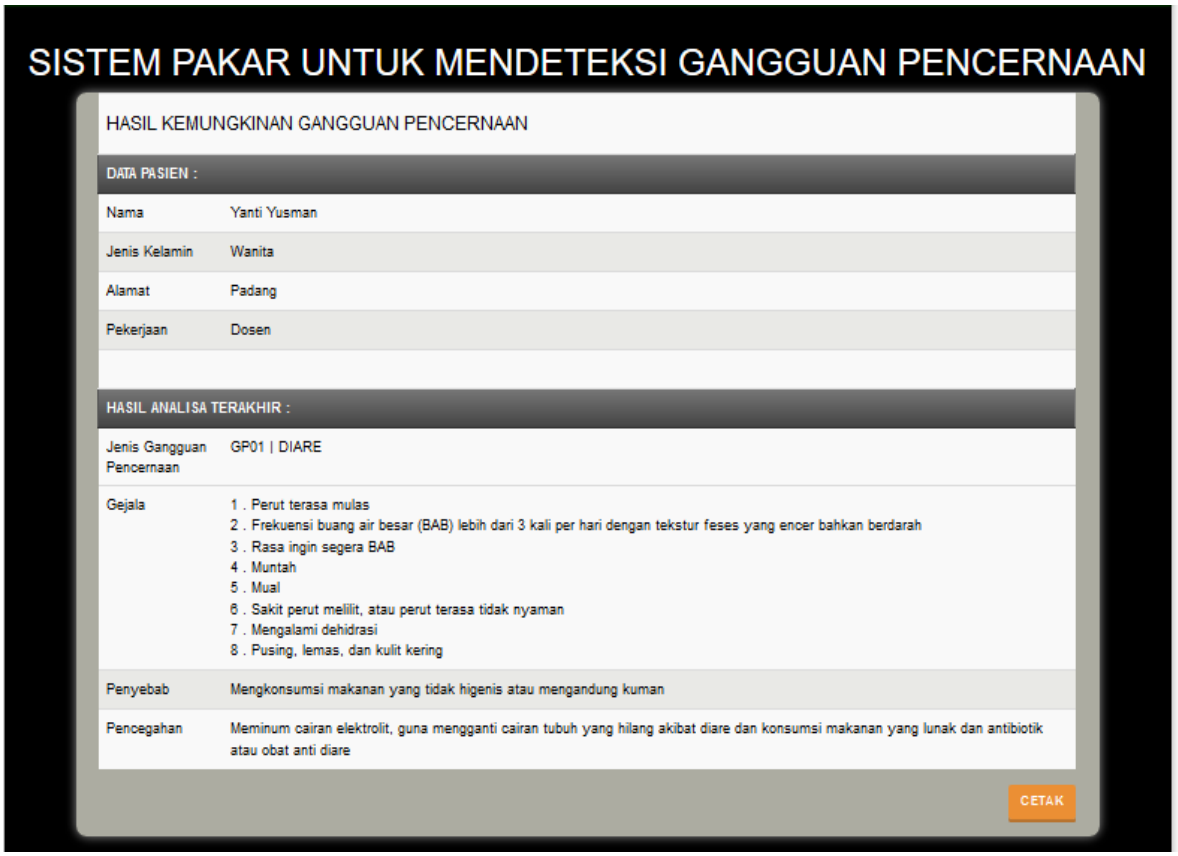

Figure 3: Consultation Results Page

As seen in Figure 3, the output generated by the system consists of patient data, namely name, gender, address, and occupation. Then there are the results of the last analysis, namely the types of digestive disorders, symptoms, causes, and prevention.

Analysis of Test Results

Expert System Testing is done by answering the Yes or No questions displayed by the system, namely on the consultation menu. After inputting your name, gender, address, and occupation, the

system will present questions according to the existing goals. The following are the results of the Expert System test:

1. *User*access the consultation menu, then the system displays the first question according to the goal in rule 1 (GP01), namely diarrhea with the question, "Do you want to know the symptoms when you have diarrhea?". If the user answers Yes, then the system will process and display the results or output which consists of symptoms, causes, and prevention which can be seen in the table below:

Table 4: System Test Results In Accordance With Rule 1 (GP01)

Question(Goals)	Do you have Diarrhea or Do you want to know the symptoms when you have Diarrhea? Answer yes"
Sympto ms (Output)	Stomach feels bloated
	The frequency of defecation (BAB) more than 3 times per day with Stool texture that is runny or even bloody
	The feeling of wanting to defecate immediately
	Vomit
	Nauseous
	Stomach ache, or stomach discomfort
	Experiencing dehydration
	Dizziness, weakness, and dry skin
Reason(Output)	Consuming food that is not hygienic or contains germs
Prevention(Output)	1. Drinking electrolyte fluids, to replace body fluids lost due to diarrhea. 2. consumption of soft foods and antibiotics or anti-diarrhea drugs

2. *User*access the consultation menu, then the system displays the first question according to the goal in rule 1 (GP02) namely diarrhea with the question, "Do you want to know the symptoms when you have diarrhea?". If not, the system will display the next question according to the goal in rule 2 (R2), namely Constipation with the question, "Do you want to know the symptoms when experiencing constipation?". If the user answers Yes, then the system will process and display the results or output which consists of symptoms, causes, and prevention which can be seen in the table below:

Table 5: System Test Results In Accordance With Rule 2 (GP02)

Question(Goals)	Do you have Constipation or Do you want to know the symptoms when experiencing Constipation? Answer yes"
Symptom (Output)	Hard defecation
	Removing hard faeces
	Need to push hard to get rid of dirt
	Feeling that there is still dirt left after defecating
	It takes extra movement to get the dirt out, like pressing the stomach or removing feces using the fingers
	Stomach ache
	Distended stomach

Reason(Output)	1. Drink a lot of milk 2. Eat less fiber 3. Not actively moving
Reason (Output)	4. Not drinking enough water 5. Are taking antacids containing calcium or aluminum 6. under stress
Prevention(Output)	1. Eat lots of fiber from fruits, whole grain breads, and cereals 2. Regular exercise 3. Don't hold your bowels 4. Drink at least 8 glasses of water a day 5. Don't drink caffeine-containing drinks 6. Don't eat dairy products

3. *User*access the consultation menu, then the system displays the first question according to the goal in rule 1 (GP01), namely diarrhea with the question, "Do you want to know the symptoms when you have diarrhea?". If not, the system will display the next question according to the goal in rule 2 (GP02), namely Constipation with the question, "Do you want to know the symptoms when experiencing constipation?". If the user answers No, then the system will display the question again according to the goal in rule 3 (GP03), namely Hemorrhoids / Hemorrhoids with the question, "Do you want to know the symptoms when experiencing Hemorrhoids / Hemorrhoids?". If the user answers Yes, then the system will process and display the results or output consisting of symptoms, causes, and prevention which can be seen in the table below:

Table 6: System Test Results In Accordance With Rule 3 (GP03)

Question(Goals)	Do you have Hemorrhoids / Hemorrhoids or Do you want to know the symptoms when experiencing Hemorrhoids / Hemorrhoids? Answer yes"
Symptom (Output)	Itching or pain around the anus Bleeding from the anusafter defecation Mucus discharge after defecation A lump hanging outside the anus
Reason(Output)	1. Constipation or diarrhea that is very severe due to having to push too hard and for a long time, 2. Frequently lifting heavy weights 3. pregnancy,Newborn 4. Sitting too long
Prevention(Output)	1. Adopt a healthy diet. 2. Taking drugs or usinghemorrhoid ointment. 3. Eat fiber-rich foods and drink lots of water 4. Avoid sitting too long 5. Delaying defecation and excessive straining

4. *User*access the consultation menu, then the system displays the fourth question according to the goal in rule 4 (GP04) namely Gastritis with the question, "Do you want to know the symptoms when experiencing Gastritis?". If the user answers Yes, then the system will process and display the results or output which consists of symptoms, causes, and prevention which can be seen in the table below:

Table 7: System Test Results In Accordance With Rule 4 (GP04)

Question(Goals)	Do you have Gastritis or Do you want to know the symptoms when experiencing Gastritis? Answer yes"

Table 7: System Test Results According to Rule 4 (GP04) (Continued)

Sympt om	Vomit
(Output)	Nauseous
	Pain that feels hot and stinging in the stomach in the solar plexus
	Bloated
	Hiccup
	Loss of appetite
	Quickly feel full when eating
	Defecation with black stools
	Vomiting blood
Reason(Output)	1. chronic vomiting, 2. Stress 3. chronic vomiting, 4. stress, **5.** Long-term use of anti-inflammatory drugs 6. **I**bacterial infection, 7. increasing age, 8. Excessive consumption of alcoholic beverages.
Prevention(Output)	1. It is recommended to make a regular eating pattern and schedule 2. Avoid oily, sour, or spicy foods, to prevent gastritis symptoms from getting worse

5. *User*access the consultation menu, then the system displays the fifth question according to the goal in rule 5 (GP05), namely Appendicitis with the question, "Do you want to know the symptoms when you experience appendicitis". If the user answers Yes, then the system will process and display the results or output which consists of symptoms, causes, and prevention which can be seen in the table below:

Table 8: System Test Results In Accordance With Rule 5 (GP05)

Question(Goals)	Do you have appendicitis or do you want to know the symptoms when you have appendicitis? Answer yes"
Deficiency Symptoms (Output)	Vomit
	Nauseous
	Bloated
	Loss of appetite
	Can't pass gas (fart)
	Constipationor diarrhea
	Fever
	Pain near the navel
	Pain when urinating
	Stomach cramps

Reason(Output)	1. Obstruction at the door of the appendix 2. Thickening or swelling of the appendix wall tissue due to infection in the digestive tract or in other parts of the body 3. Stool or parasitic growth that clogs the cavities of the appendix 4. Injuries to the stomach
Prevention(Output)	RequiredSurgery To Remove Appendix

CONCLUSION

Based on the research and discussion conducted, it can be concluded several things as follows: This web-based expert system can provide convenience for the public to find out the symptoms of each type of digestive disorder. Backward Chaining Inference can help the process of detecting digestive disorders by outputting the symptoms of each type of digestive disorder.

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