



# Application of Expert System for Diagnosing Gastric Disease Android Based with Certainty Factor Method

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## ABSTRACT

*Expert systems are computer programs that mimic reasoning an expert with expertise in an area of knowledge, the present study, how to diagnose diseases of the stomach to build an expert system that can analyze the symptoms of the disease into a decision, the method Certaitiy Factor as a method for calculating confidence in the value provided by the patient's symptoms. The purpose of this study is to provide convenience to the public for mediagnosa a disease of the stomach suffered and gave information about diseases of the stomach and provide solutions when terjankit gastric diseases. Of the many diseases in carefully then there are various symptoms sample to meet the needs of the weights that have been defined by experts.*

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## 1. Introduction

Based on this research problem purpose wish to use way to design and build an information system applications and diagnosis of diseases of the stomach which can be used by mobile to let users easily identify a disease wherever the user is located. Which will be the only application can provide information about the stomach, gastric disease data, the symptoms of gastric disease, how to prevent and how to treat and diagnose diseases of the stomach. Of the value of the test in the form of a percentage of the results of calculations based on a formula that berakhi certainty factor to a conclusion, in which the expert system to diagnose just about diseases that exist in the stomach. And the certainty factor method set out only to determine the outcome of diagnosis.

Disorders of the stomach is very disturbing digestion for the sufferer, and is based on the pain and heat in the abdomen, then with the establishment of an application that uses the calculation certainty factor in diseases of the stomach will have a percentage of the level of confidence that can be used in the community to find out early a disease that has suffered [1].

In the previous application implementation developed using the concept of web based so less efficient [2]. Using the android is very young and can be used at any time by the patient, to be able to detect the early symptoms of the disease [3]. In another study, The value of such trust is the result of calculations using the method of Certainty Factor. And other metodei provide solutions to new cases by looking at the old case that comes closest to the new case is Case-Based Reasoning [4]. Then do also research defines the size of certainty to a facts and rules, to describe the level of confidence of experts on the matter at hand, using Certainty Factor [5].

So seen from previous studies, the Certainty Factor is an appropriate method to perform the process of calculating the possibilities, this study aims to help users to diagnose the disease that has experienced and can help experts and parents who want to know and learn this science to mendiagnosa disease hull.

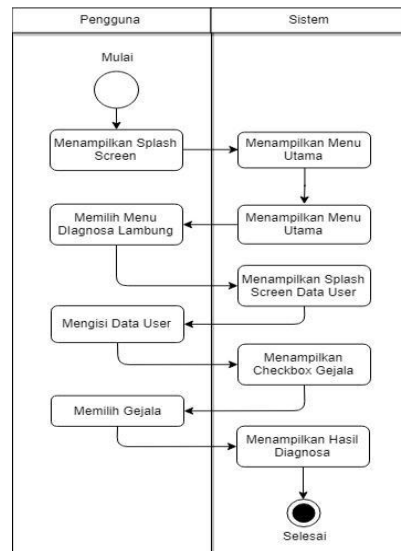


## 2. Research Methods

This study uses Certainty Factor which is useful in the field of probability scale calculations at a decision, this method is used to analyze gastric disease in humans.

### A. Diagram Design System

System diagram illustrates the various streams of activity in the system that is being designed how each flow starts, decision that might occur, and how they ended. Diagram of the system can also describe parallel processes that may occur in some instances execution in the picture below .:



**Fig 1.** Diagram System

Explanation of the research framework:

- 1) from  
Running the application and then go into the menu and select Diagnose menu in the main menu.
- 2) Main course  
At this stage we can watch the many menu choices are: info stomach, diagnostics, archive, about the disease. Then select the menu Diagnostics to detect the symptoms experienced.
- 3) User Data Input  
This stage we have to fill the data themselves to meet the requirements in diagnosing the disease, which must be completed, namely, the name must be filled in order to know who has been diagnosed, the age of which could become a benchmark in this study, and Gender in order to distinguish an identity. Then there is the button "OK" which will continue to the next page if the data already loaded all, and the button "CANCEL" to return to the main menu.
- 4) select Symptoms  
At this stage there is a choice of symptoms in gastric diseases using Chcekbox features. And select some symptoms of the disease in order to perform all processing stages.
- 5) Process  
This Ditahapan perform calculations on an application by using the method of Certainty Factor so that the symptoms suffered by the user to determine the outcome of the illness.

Using Certainty Factor is a method to ensure a fact, which is the fact that definitely or uncertain and that fact will form the usual metric digunaka in expert systems. This method is suitable for diagnosing disease expert system in which a thing is uncertain. [6]

In using the degree of confidence using a value called Certainty Factor (CF) to assume a degree of confidence terhadap experts Suati data. Here is a basic formula of Certainty Factor:



$$CF [H, E] = MB [H, E] - MD [H, E] \quad (1)$$

Information :

CF = *certainty Factor* (Certainty factor) in the hypothesis H which is influenced by the fact E.

MB = *Measure of Belief* (Confidence level), is a measure of the increase of trust hypothesis H is affected by the fact E.

MD = Measure of Disbelief (not confidence level), is the belief of mistrust hypothesis influenced the fact E

E = Evidence (events or facts)

H = Hypothesis (Alleged)

To combine two or more rules, knowledge-based systems with multiple rules, each of the rules to the same conclusion but different uncertainty factor, then any rule can be displayed as a piece of evidence that supports the conclusion together. To calculate CF (confidence) will need a combination of the following [7]:

$$CF (R1, R2) = CF (R1) + [CF (R2)] \times [1 - CF (R1)] \quad (2)$$

If we just add CF R1 and R2, the certainty of the combination will be more than 1 modifies the amount of certainty through the addition of the second certainty factor and multiplying (1 minus the first certainty factor). Thus, the greater the smaller the first CF certainty addition of a second. But an additional factor always add some certainty. For the third rule is added, it can be used rule as follows:

$$CF (R1, R2, R3) = CF (R1, R2) + [CF (R3)] [1 - CF (R1, R2)] \\ = CF (R1, R2) + CF (R3) - [CF (R1, R2)] \cdot [CF (R3)] \quad (3)$$

To find the confidence factor information from experts, in view of the CF (R1, R2, R3) then it should be guided by the interpretation table (term) Certain Factor [8].

**Table 1.**

Terminology Value Expert		
No.	Conditions Certainty	CFpakar
1.	definitely Not	0
2.	Almost not	0.2
3.	sure enough	0.4
4.	Sure	0.6
5.	almost sure	0.8
6.	Very sure	1

in disease diagnosis session, the user is given the option of interpretation that each has a CF value as follows:

**Tabel2.**

Terminology Value User

No,	Conditions Certainty	CFuser
1.	Not Sure (photo)	0
2	Very Confident (Yes)	1

The calculation process in Table 2, namely, the percentage of user confidence begins with the selection formula that makes solving in determining a decision in order to get the value of possibilities.

6) result

This stage showing the calculation of the process stages. At this stage given two choices confidence in the diagnosis of the disease, namely, the button "SAVE" to enter into the menu diagnosis archive that has been declared. The other one button "BACK" if less confident in the results and return to the Select symptoms to select the appropriate symptoms return.

7) Done



The final stage of use of the application, and the diagnosis of gastric disease in the correct state.

### B. Method of Testing

The method of testing is a way or technique to test the software, have a mechanism to determine the test data to test a complete software and have a high probability of finding errors, the testing methods used in this study is the method of Black Box.

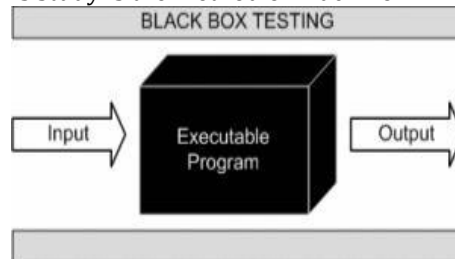


Fig 2. Main Menu Display

Functional testing or black box testing (Black Box testing) is an approach derived from the testing that the test program or component specification. The system is a "black box" whose behavior can only be determined by studying the input and output related. Another name for this method is the functional testing because the test is only concerned with the functional and not the implementation of software [9].

## 3. Results and Discussion

### A. System Requirement Analysis

In the design of digital image compression application, it takes the form of a support device (hardware) and software (software), yang terdiri of:

- 1) Hardware requirements: Intel® Core™ i5-7200U 2.5GHz Laptop 64 bit with 12GB RAM.
- 2) Software requirements:
  - a) Draw.io
  - b) Android Studio
  - c) Microsoft Excel 2016
  - d) Adobe Photoshop CS3

### B. Diagnosis of Gastric Appviews

This study was designed to establish probability analysis using ANDROID software STUDIO. Views are built can be seen in the figure below.

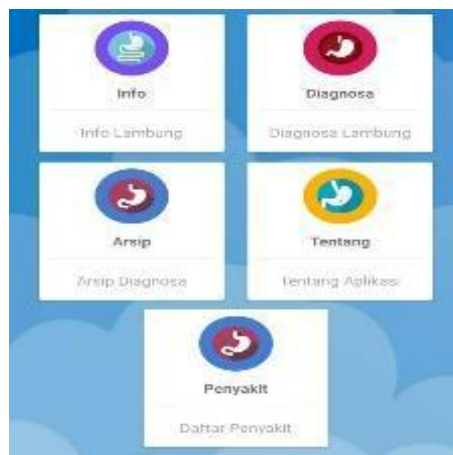


Fig 3. Main Menu Display



In Figure 3, attached to the Main Menu page in which is located the menu to choose from. On the menu tersebut have their respective functions are useful to help determine what information, detail, solutions, and symptoms of gastric disease.

**Fig 4.** Personal Data Layer

In Figure 4, attached on Layer data themselves are displayed is a form that must be filled in order to qualify to be able to go to the next menu.

**Fig 5.** Layer Symptoms

In Figure 5, the attached layers symptoms that displays a menu that can be selected Sesuai with symptoms of the disease using Checkbox features.



Fig 6. Layer Calculation Results

In Figure 6, attached Layer Certainty Factor calculation process in which we can see the weights and formulas that have been used to obtain the results that potentially determine a final result is a disease accordingly.

### C. Analysis and Design

The following is a table of weights and basic knowledge or information about the disease in the stomach, which was based on a reference in the book [10].

**Table 3.**  
Table Weight Symptoms

P	SYMPTOMS																
	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	G16	G17
P1	0.8	0.2	0.6	0.6	0.4	0	0.6	0.4	0	0.2	0	0.6	0.6	0	0	0.6	0.2
P2	0.6	0.8	0.8	0.8	0.6	0.6	0.4	0.6	0	0	0	0.6	0.8	0.4	0	0.6	0
P3	0.4	0.6	0.4	0.6	0.8	0.8	0.6	0.4	0.8	0.4	0	0.6	0.8	0.4	0.4	0.8	0.8
P4	0	0.4	0	0.6	0.8	0	0.8	0.2	0	0	0.8	0.8	0.6	0	0	0.6	0.8
P5	0.6	0.8	0.8	0.8	0	0.6	0.6	0.6	0.6	0.4	0	0	0	0	0	0.4	0
P6	0.6	0	0.4	0.4	0.6	0.6	0.8	0.4	0.6	0.8	0	0.4	0.6	0.8	0.4	0.4	0
P7	0.4	0	0.8	0.8	0	0	0.4	0	0	0	0	0.8	0	0.2	0.8	0.8	0.4
P8	0.8	0	0.2	0.8	0	0	0.8	0.4	0.2	0	0.8	0.6	0	0.2	0	0.8	0.8

**Table 4.**  
Stomach symptoms

No.	Code symptom	Symptom
1.	G1	Stomach feels bloated
2.	G2	Experiencing pain in the pit of the stomach
3.	G3	easy satiety
4.	G4	Nausea and vomiting
5.	G5	Arising bleeding in the stomach
6.	G6	often saltpeter
7.	G7	Pain or discomfort in the upper abdomen
8.	G8	Hot feeling in the chest and abdomen
9.	G9	Sour gas issuing from the mouth
10.	G10	The pain and discomfort when swallowing
11.	G11	Headache and fever
12.	G12	Pain in the chest



13.	G13	Digestive problems and changes in feses
14.	G14	Frequent cough - cough
15.	G15	low blood sugar
16.	G16	Appetite and weight loss
17.	G17	easily fatigued

Table 4, which dibama symptoms of the stomach is converted into a code in order to simplify the calculation in this study, therefore, the present study is needed tables to become a reference in making data summary as well as the weight to count and get the value of possibilities. And then continued to the next table

**Table 5.**  
Stomach symptoms

No.	CODE	NAME OF DISEASE
1.	P1	gastritis
2.	P2	Gastric
3.	P3	Gastric cancer
4.	P4	Tumor Benign Gastric
5.	P5	dyspepsia
6.	P6	GERD
7.	P7	Gastroparesis
8.	P8	Gastronteritis

**Table 6.**  
table Rules

No.	CODE OPT	NAME OF DISEASE
1.	P1	G1, G3, G4, G7, G12, G13,16
2.	P2	G1, G2, G3, G4, G5,6,8, G12, G13, G16
3.	P3	G2, G4, G5, G6, G7, G9, G13, G16, G17
4.	P4	G4, G5, G7, G11, G12, G13, G16, G17
5.	P5	G1, G2, G3, G4, G6, G7, G8, G9
6.	P6	G1, G5, G6, G7, G9, G10, G13, G14
7.	P7	G3, G4, G12, G15, G16,17
8.	P8	G1, G4, G7, G11, G12, G16, G17

Based on data from a table of data Gastronteritis knowledge have been as follows:

**Table 7.**  
table sample

Symptoms code	symptom	Selection
G7	Pain or discomfort in the upper abdomen	Possible YES
G3	easy satiety	Possible NO

Example Calculation:

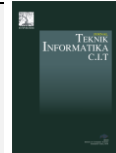
Production rule or rule related to gastric diseases are as follows:

**IF** Bloating

**AND** Pain or discomfort in the upper abdomen

**AND** Low blood sugar



**THEN** Gastreonteristis

The obtained results the following calculation:

## 1) Gastreonteristis

- Calculation Value CF G7

$$\begin{aligned} \text{CF (G7)} &= \text{CF (expert)} * \text{CF (user)} \\ \text{CF (G7)} &= 0.6 * 1 \\ &= 0.6 \end{aligned} \quad (4)$$

- CF Value Calculation G15

$$\begin{aligned} \text{CF (G3)} &= \text{CF (expert)} * \text{CF (user)} \\ \text{CF (G3)} &= 0.2 * 1 \\ &= 0.2 \end{aligned} \quad (5)$$

- COMBINE CF Value Calculation

$$\begin{aligned} \text{CFcombine} &= \text{CF (G7)} * \text{CF (G3)} (1-\text{CF (G7)}) \\ &= 0.6 + 0.2 * (1 \text{ to } 0.6) \\ &= 0.68 \end{aligned} \quad (6)$$

- Percentage confidence =  $\text{CFcombine} * 100\%$   
 $\Rightarrow 0.68 \times 100\% = 68\%$  (7)

The results of manual counting showed all kinds of illnesses connected with the selected symptoms, with the percentage of each. The system will only show the disease with the highest percentage of first.

#### 4. Conclusion

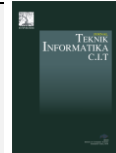
After a discussion of the previous chapters, this study may conclude as follows:

- Application of expert system to make it easy for patients to diagnose diseases of the stomach.
- Based on the results of the discussion the diagnosis expert system diseases of the stomach can be done by using the method of Certainty Factor ..
- Output in this application is to combine information about the kinds of stomach and gastric diseases with the diagnosis of diseases of the stomach into a single application that allows users or patients, without having to burden the system by opening two different applications.

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