Expert System for Detection of Diseases in Layers Using Forward Chaining and Certainty Factor Methods

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Abstract

Inaccuracies in the process of diagnosing a type of disease result in errors in handling so that it will pose a risk of death. Accurate diagnostic process results require a high level of confidence so that the results are truly convincing. Current technological developments are making more and more mindsets for the development of information technology in the field of computerization born. One of them is an expert system. This expert system is often used to analyze disease in laying hens. The deficiency in previous research is that there is no degree of confidence so what happens is that the diagnosis often only uses the value of the expert. The role of the system user is only to select the available symptoms without giving the weighted value of the selected symptoms. This study aims to build an expert system capable of detecting symptoms in laying hens by assigning a degree of confidence to each symptom. The system is built with a combination of forward chaining techniques with a certainty factor, the weight value is based on a combination of the weight of symptoms from users and experts to anticipate conditions that are not ideal. Several stages in the research include data collection, knowledge base modeling, implementation into applications and testing. The conclusion that can be drawn from the trial results is that the system can show a maximum validity value of up to 100% when compared to manual calculations.

Keywords : *Expert System, Forward Chaining, Certainty Factor*

1 INTRODUCTION

Laying hens is one of the business commodities that has developed rapidly and is a quite promising business. This is because the eggs are in great demand by the public. However, to obtain good results and large profits, laying hen breeders must pay more attention to how to care for and raise livestock. If not, laying hens will be susceptible to disease so that it can reduce the productivity of laying hens. When laying hens are exposed to disease, the owner or breeder of chickens is expected to be able to treat and prevent it so that the disease does not spread to other laying hens. According to Sudaryani [1], diseases in chickens are usually caused by bacteria, viruses, fungi, parasites, food poisoning or deficiencies of certain substances. Types of diseases of laying hens that are not known as natural viruses or parasites that cause disease. Infection found in laying hens can be transmitted to other laying hens. Thus, chicken disease is a type of disease that must be handled properly, quickly and precisely by the owner from an early age. The difficulty for breeders to obtain information about the types of diseases in laying hens is a major obstacle and threat to breeders. This will result in delays in handling causing the death of chickens which will certainly be detrimental to laying hen breeders.

Along with the development of knowledge, computer technology is also progressing, one of which can be used to make expert system applications. The smarter the system and the more advanced the level of information handling, the more active the role played by the computer and even so far there has been an increase in interest in using computers for artificial intelligence. One branch of artificial intelligence is an expert system. According to Budiharto [2], an expert system is a computer program that simulates judgments and behavior of humans or organizations that have expert knowledge and experience in a particular field, whereas according to Widiastuti [3], an expert system is an intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require an expert to solve them. The basis of an expert system is how to transfer the knowledge possessed by an expert to a computer, and how to make decisions and draw conclusions based on that knowledge.

In making expert systems, there are many methods that can be used, including backward chaining, forward chaining, depth-first search, best-first search, Analytical Hierarchy Process (AHP), certainty factor, and others. According to Turnawan [4], forward chaining means using a set of behavioral-state conditions. Backward chaining is a tracking method that starts from expectations or goals and then tries to find evidence or facts that support the hypothesis [5]. The depth-first search method is a search method on a tree by tracing one branch of a tree until it finds a solution, while the best-first search is a method that performs a wide search that visits preorder nodes, namely visiting a node then visiting all nodes. that neighbors the node first [6]. AHP is a concept for making decisions based on multiple criteria. Several criteria compared to one another (level of importance) are the main emphasis on this AHP concept [7]. The certainty factor method can be summed up as a method for measuring the certainty of a fact or rule [8].

Given the current problems, where there is still a lack of knowledge of laying hens about handling diseased chickens, especially laying hens, an expert system application is needed to assist in diagnosing disease in laying hens.

2 LITERATURE REVIEW

Several previous studies have written about implementing expert systems using the forward chaining method and certainty factors, including research conducted by Anggrawan [9] in a journal entitled Expert System for Diagnosing Diseases of Broiler Using Forward Chaining and Certainty Factor. This study discusses whether the combination of the forward chaining method with the certainty factor can accurately diagnose disease in broilers. The test results show that the expert system prototype that has been created by applying the forward chaining method and the certainty factor can diagnose the type of broiler disease based on the symptoms entered by the user.

Then research was conducted by Rahmah [10] in a journal entitled Application of Certainty Factor in Expert Systems Gastrointestinal Disease Diagnosis Broiler Chicken. In this research, a series of trials were carried out to prove the accuracy of the certainty factor method. The test results conclude that the certainty factor method is able to accurately perform calculations on the symptoms entered by the user so that digestive tract diseases in broiler chickens can be identified. Yuwono [11] in an article entitled the application of the forward chaining method and certainty factor to an expert system for diagnosing coelogyne pandurata orchid pests. The test results from this study explain that the forward chaining and certanty factor methods can provide a pest diagnosis on the Coelogyne Pandurata Orchid based on the symptoms given. From the calculation results, the information on the level of confidence based on the expert's interpretation table and the final percentage of 93.0736% is very likely that these two methods are applied to solve the existing problems.

Research conducted by Nanda [12] raised the topic of the forward chaining method and the certainty factor for diagnosing disease in Android-based active smokers. The trial results show that the certainty factor method is accurate for diagnosing disease in active smokers with a confidence level of 97.75%. Nengsih [13] in his article entitled Expert System Using Forward Chaining and Certainty Factors to Diagnose Smartphone Damage. This article describes the Accuracy of the Forward Chaining Method and Certainty Factor for Diagnosing and Analyzing Smartphone Damage Data. The test results concluded that the designed expert system can determine the type of damage that occurs on a smartphone with an accuracy of up to 73.33%. Furthermore, research conducted by Indriyono [14] in an article entitled Expert System for Detecting Diseases of Potatoes of Granola Varieties Using Certainty Factor Method, explains the accuracy of the ceratinty factor method in detecting potato diseases which reaches 94%. This can be interpreted that the certainty factor method is quite accurate in calculating accuracy in expert systems.

2.1 EXPERT SYSTEM

An expert system is defined as a computerized system that involves knowledge, facts and reasoning techniques in solving problems that usually can only be solved by an expert in that field [15]. According to Darsin [16], an expert system is a system designed to be able to act like an expert in answering questions to solve a problem. Expert systems are able to deliver solutions to problems obtained from dialogue with users. By using an expert system, a person who is not an expert in a particular field is able to provide answers to questions asked, solve problems and make decisions that are usually made by an expert.

Expert systems have two important parts, namely the knowledge base and the inference engine [17]. Expert systems have a goal not as a substitute for an expert, but to socialize the knowledge and experience of experts who are experts in their field [18]. There are two important parts in an expert system, namely the development environment and the consulting environment. Figure 1 below shows the details of the components that make up the expert system structure [19].

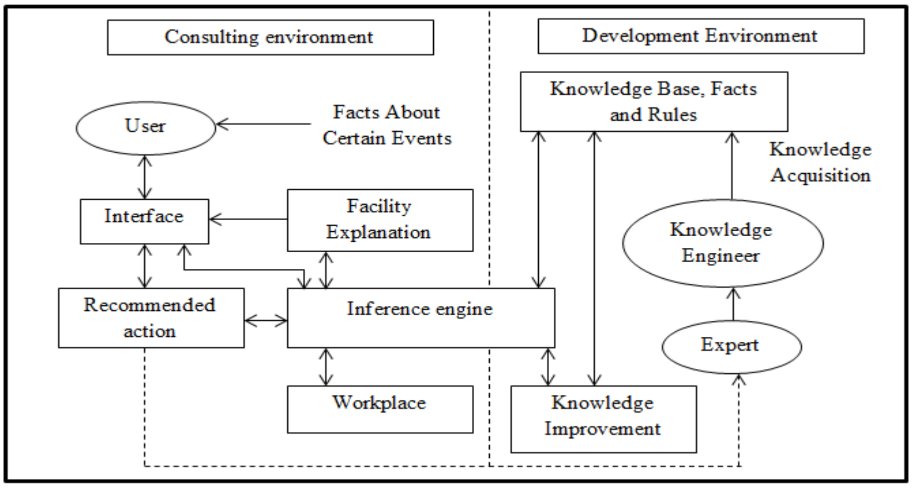

Figure 1 Expert System Structure

From the structure above, an explanation can be given as follows: User : Users who use the system to consult on the symptoms they are experiencing; Interface : It is used to communicate between the user and the system; Knowledge base: Knowledge base section that contains a set of facts, theories, thoughts and relationship between one another; Acquisition of knowledge: Part of the expert system as for extracting, structuring, and making the organization of knowledge from various sources. Inference engine: Is a component that has the ability to draw conclusions according to experience. Workplace : is an area of several working memory that functions to store the results of the conclusions reached. Explanation facility: A part that functions to make an expert system more capable by providing a rational picture to the user. Improved knowledge: In this case, experts need to increase their ability so that the system is more optimal in evaluating whether existing knowledge is still suitable for use in the future.

2.2 KNOWLEDGE REPRESENTATION

According to Ramadhan [20], there are several techniques in developing expert systems including: (1) knowledge based on rules, (2) knowledge based on objects, (3) knowledge based on frameworks and (4) based on mindset. Of the four techniques, rule-based is a technique that is often used by expert system developers where the general form of rule-based is in the form of an if…then (if…then) rule [21].

The results of the acquisition and representation of knowledge from an expert are embodied in the form of a knowledge base. The knowledge base contains a collection of knowledge to solve a problem. In general, this knowledge base has two models, namely: (1) Reasoning in a rule base which means that a knowledge is implemented using If-Then rules. This model is used when there is a certain amount of expert knowledge on a particular problem where the expert can carry out sequential solutions. (2) Reasoning on a case basis, which means that the knowledge base contains a number of solutions that have been achieved previously, then a solution is derived for the current situation [22]. The diagnostic program decides which rules are investigated, which diagnoses are eliminated and which attributes are adjusted [23].

2.3 FORWARD CHAINING METHOD

Forward chaining is an inference method that functions as a knowledge-based system processor to generate new knowledge from known information. The forward chaining method approach is a sequential process that begins by displaying a collection of convincing data or facts leading to a final decision. This approach begins with collecting data in the field, which is then processed to reach a final conclusion [24]. According to Rahmatullah [25] forward chaining is a forward tracking technique using a data-driven approach. In this approach, the tracking process begins with user input and continues Process a conclusion. Forward chaining is a technique that uses a set of action-condition rules. In this technique data is used to decide which rule to execute. The process is repeated several times until the results are obtained [26].

Forward chaining traces a problem and finds a solution. As illustrated in Figure 2 below:

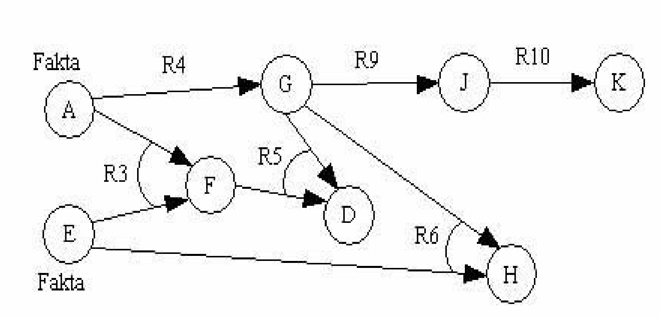

Figure 2. Forward Chaining Tracing Flow [27]

From Figure 2 above, it can be explained as follows: In R3, both A and E are facts so obviously true. Thus F as a consequent is also true. So now there is a new fact, namely F. Because F is not a hypothesis to be proven (=K), the search continues to R4. Then in R4, A is a fact, so it is clear that it is true, thus G as a consequent is also true. So now a new fact is obtained, namely G. Because G is not hypotensive to be proven (=K), then the search continues to R5. In R5, both F and G are true according to the rules of R3 and R4. Thus G as a consequent is also true.

So now we get a new fact D. Because D is not hypotensive to prove, then the search continues to R6. In R6, both A and G are true based on the facts of R4. Thus H as a consequent is also true. So now there is a new fact, namely H. because it is not hypotensive to be proven, the search for R6 stops at H. In R9, J is true because G is true based on R4. Because J is not hypotensive to be proven, the search continues to R10. In R10, k is true because j is true based on R9. Because K is already a hypotensive to be proven, it is proven that K is true.

2.4 CERTAINTY FACTOR METHOD

The certainty factor method is widely applied when encountering problems where the answer is uncertain. This element of uncertainty can become a probability. This method was first introduced by Shortlife and Buchanan in the 1970s. The certainty factor has to accommodate the uncertainty of experts who often think of analyzing information with phrases such as "no", "maybe", "don't know", "almost certain", "most likely" and "certainly"

[28]. The certainty factor method assumes the level of expert confidence for the data used. The certainty factor introduces the concepts of trust and uncertainty [29]. Certainty factors are appropriate for diagnosing something that is uncertain.

2.5 CERTAINTY FACTOR CALCULATION

In the Certainty Factor calculation, there are different rules with the same consequences. By calculating the overall CF value of each existing condition. The concept of Certainty Factor is also often known as belief and disbelief. There are two models that are often used in calculating the confidence level (CF) of a rule, as follows [31]:

1. The "Not Believe" method proposed by E.H. shortliffe and B.G. Buchamanu
   CF(rule) =MB (H,E)-MD(H,E) …(1)
   Information :

   CF[H,E] : The hypothesis certainty factor that is influenced by evidence E is known with certainty.
   MB[H,E] : measure of believe in hypotension h, if given evidence E (between 0 and 1)
   MD : Measure of Disbelief (Uncertainty value)
   P : probability
   E : evidence (events or facts)

2. By taking data from interviews with experts, the CF value (rule) obtained from the interpretation of the tram from the expert becomes a certain CF value as follows:
   a. Not :0
   b. Don't Know :0,2
   c. Possible :0,4
   d. Most likely :0,6
   e. Almost certainly :0,8
   f. Certainly :1.0

   From the CF value of each rule, the calculation will be combined to get the CF value from the diagnostic results. Here is the formula for calculating CF (combine)
   CF(Combine) =CF1 + CF2)* (1-CF) …(2)
   Information:
   CF (Combine) : combined certainty factor.
   CF1 : The CF value of Rule 1
   CF2 : The CF value of Rule 1

   If there are values from the 2 selected rules then the calculation is repeated with CF1 being the result of the first CF (Combine) calculation while CF2 is replaced with CF the value of the next rule that is selected. Perform these calculations so that the last

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rule is selected. To calculate the diagnostic achievement is the result of the value of CF (Combine)* 100%.

3 RESEARCH METHOD

In this study the research method used is the research and development method. Research and development methods are defined as research techniques carried out to produce certain products, and test the effectiveness of products. The research method used can be illustrated as shown in Figure 3.

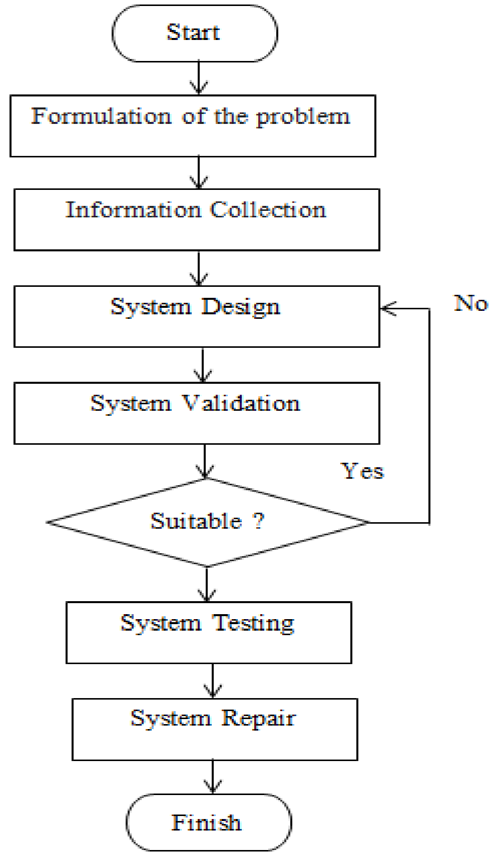

Figure 3 Flow of Research Methods

Based on Figure 3 above, it can be described the steps carried out in this study as follows :

a. Formulation of the problem. The initial step taken by the researcher was to formulate what was the problem in this study, namely how to determine the type of disease suffered by laying hens more accurately.
b. Information collection. After the problem is defined, the next step is to gather information from various sources related to the type of disease in laying hens and the symptoms experienced. Information was obtained both primarily through laying hen breeders and secondary in the form of books and relevant articles.
c. System design. In this section, system design is carried out related to the problems to be solved before being implemented into the application program.

d. System validation. After completing the system design, the next step is to validate whether the system design is running according to the design and methods used.
e. Suitable. During the validation process, a match is made whether the system design is appropriate or not. If it is not appropriate then the system is improved by design
f. System testing. After the system design is appropriate, the next meal is to test the system with actual conditions, namely testing with existing cases to prove the accuracy of the system in solving problems.
g. System repair. At this stage, adjustments or repairs to the system are made if the system is deemed imperfect and still experiencing errors until the system is completely error free.

4 RESULT AND DISCUSSION

In the discussion section, examples of cases and calculations of solutions are given as well as overall test results.

4.1 DATA ANALYSIS OF CHICKEN DISEASES

Laying hen disease data used in this study were obtained from the literature that discusses laying hen diseases. The data on laying hen diseases that the author managed to collect are shown in Table 1.

Table 1. Disease Data of Laying Hens

Disease Code	Disease Name
P01	Lime stools (Puilorum)
P02	Cholera (Fowl Cholera)
P03	Bird Flu (Avian Influenza)
P04	ND (New Castle Disease)/ totelo
P05	Typhus Chicken (Fowl Typhoid)
P06	Diarrhea (Coccidosis)
P07	Gumboro (Gumboro Disease)
P08	Salesma Chicken (Infectious Coryza)
P09	Chronic Chicken Cough (Infectious Bronchitis)
P10	Chicken Edema (Lymphoid Leukosis)
P11	Coughing up Blood (Infectious Laryngotract)
P12	Mareks (Mareks Disease)
P13	Egg Production (Egg Drop Syndrome 76/EDS 76)

4.2 DISEASE SYMPTOM ANALYSIS

In addition to the need for data on the type of disease, this research also obtained data on disease symptoms that are generally experienced by laying hens. The symptom data is shown in Table 2.

Table 2 Data on Disease Symptoms of Laying Hens

Symptom Code	Disease Symptom Name
G01	Decreased appetite
G02	Shortness of breath / gasping
G03	Wet snoring breath
G04	Sneezes
G05	Cough
G06	Dull and wrinkled fur
G07	Diarrhea
G08	Egg production decreases
G09	Freezing
G10	Looks lethargic
G11	Greenish diarrhea
G12	Whitish diarrhea
G13	Pale face
G14	Looks blue
G15	Wattle swelling
G16	Pale crest
G17	Paralyzed legs and wings
G18	Discharge from eyes and nose
G19	Swollen head
G20	Head turned
G21	Swelling of the sinuses and eyes
G22	Growing belly
G23	Hanging wings
G24	There is white feces stuck around the anus
G25	Sudden death
G26	Coarse eggshell
G27	Watery Egg White
G28	Greenish yellow feces
G28	Swelling of the facial area and around the eyes
G30	Bloody stools or stools
G31	Huddled in the corner of the cage
G32	Peck at the cloacal area
G33	Peck at the cloacal area
G34	Smaller eggs
G35	Paralysis of the cache
G36	Breathe through your mouth while sticking out your neck
G37	Bleeding cough
G38	Sleeping beak placed on the floor
G39	Sit with a hunched over
G40	Sleepy looking with standing hair
G41	Thin body
G42	There is mucus mixed with blood in the oral cavity
G43	Limping legs

4.3 DISEASE RULE ANALYSIS

After obtaining data on the types and symptoms of laying hen diseases, rules or rule based are then made based on the type of disease and symptoms experienced. The rules are shown in Table 3.

Table 3 Rule Data

Rule	Production rules	Md	Mb	Certainty Factor Rle
RL1	G01 → P01	0,4	0,2	0,2
RL2	G12 → P01	0,8	0,2	0,6
RL3	G23 → P01	0,6	0,2	0,4
RL4	G24 → P01	1.0	0,0	1,0
RL5	G01 → P02	0,4	0,2	0,2
RL6	G03 →P02	1,0	0,2	0,8
RL7	G15 → P02	1,0	0,0	1,0
RL8	G21 → P02	1,0	0,0	1,0
RL9	G13 → P03	0,6	0,2	0,4
RL10	G14 → P03	1,0	0,0	1,0
RL11	G19 → P03	0,6	0,2	0,4
RL12	G25 → P03	1,0	0,0	1,0
RL13	G01 → P04	0,4	0,2	0,2
RL14	G02 → P04	0,4	0,2	0,2
RL15	G04 → P04	0,8	0,2	0,6
RL16	G10 → P04	0.4	0,2	0,2
RL17	G11 → P04	0,8	0,0	0,8
RL18	G20 → P04	0,8	0,2	0,6
RL19	G01 → P05	0,6	0,2	04
RL20	G16 → P05	1,0	0,2	0,8
RL21	G23 → P05	0,8	0,2	0,6
RL22	G28 → P05	1,0	0,0	1,0
RL23	G06 → P06	1,0	0,2	0,8
RL24	G09 → P06	0,8	0,2	0,6
RL25	G10 → P06	0,8	0,2	0,4
RL26	G30 → P06	1.0	0,0	1,0
RL27	G31 → P06	0,8	0,2	0,6
RL28	G01 → P07	0,4	0,2	0,2
RL29	G32 → P07	1,0	0,0	1,0
RL30	G38 → P07	1,0	0,0	1,0
RL31	G39 → P07	1,0	0,2	0,8
RL32	G02 → P08	0,8	0,2	0,6
RL33	G18 → P08	0,8	0,2	0,6
RL34	G29 → P08	1,0	0,0	1,0
RL35	G01 → P09	0,4	0,2	0,2
RL36	G05 → P09	1,0	0,0	1,0
RL37	G09 →P09	0,8	0,2	0,6
RL38	G40 → P09	1.0	0,0	1,0
RL39	G01 → P10	0,4	0,2	0,2
RL40	G02 → P10	0,8	0,2	0,6
RL41	G22 → P10	1,0	0,0	1,0

Rule	Production rules	Md	Mb	Certainty Factor Rle
RL42	G41 → P10	1,0	0,0	1,0
RL43	G02 → P11	0,8	0,2	0,6
RL44	G36 → P11	1,0	0,2	0,8
RL45	G37 → P11	1,0	0,0	1,0
RL46	G42 → P11	1,0	0,0	1,0
RL47	G01 → P12	0,4	0,2	0,2
RL48	G17 → P12	0,8	0,2	0,6
RL49	G35 → P12	0,8	0,0	0,8
RL50	G43 → P12	1,0	0,0	1,0
RL51	G07 → P13	0,8	0.2	0,6
RL52	G08 → P13	1,0	0.0	1,0
RL53	G26 → P13	0,8	0,2	0,6
RL54	G27 → P13	0,8	0,2	0,6
RL55	G33 → P13	0,4	0,2	0,2
RL56	G34 → P13	0,6	0,2	0,4

4.4 SAMPLE CASE

A chicken farmer found that his chickens were affected by a disease with symptoms such as decreased appetite, paralyzed legs and wings, head rotation, and paralysis of the crop. From these symptoms, the farmer wants to know what disease his chickens are suffering from. Then the solution of this case can be described as follows.

Known symptoms include:

1. Decreased appetite (G01), is a symptom of Lime Defecation (P01), Chicken Cholera (P02), Tetelo (P04), Chicken Typhus (P05), Gumboro (P07), and Mareks (P12).
2. Legs and wings are paralyzed (G17), a symptom shared by Tettelo (P04) and Mareks (P12).
3. The head is turned (G25), a symptom that is owned by Tetselo (P04) and Mareks (P12)
4. Paralysis of the cache (G35), is a symptom that is owned by Mareks (P12).

From these symptoms, the following manual calculations can be made:

h. Typhus Chicken (P05) =
 Decreased appetite (G01) = 0.4 = Highest score for (G01)
 CF (H,E) = CF(E) * CF (Rule)
 CF 1 = 1 * 0.4
 (G11) = 0.4

i. Tetelo (P04) =
 Decreased appetite (G01) = 0.2
 Paralyzed legs and wings (G17) = 0.6
 Head rotated (G20) = 0.4
 CFcombination (old CF, new CF) = old CF+new CF * (1-Cfold)
 CFcombination G01,G17 = 0.2 + 0.6 * (1 – 0.2)
 = 0.68

CFcombination G17, G20 = 0.68 + 0.4 * (1 – 0.68)
= 0.808

j. Mareks (P12) =

Decreased appetite (G01) = 0.2
Paralyzed legs and wings (G17) = 0.6
Head rotated (G20) = 0.6
Crashes in cache (G35) = 0.8
CFcombination (old CF, new CF) = old CF+new CF * (1-Cfold)
CFcombination G01,G17 = 0.2 + 0.6 * (1 – 0.2)
= 0.68
CFcombination G17, G20 = 0.68 + 0.6 * (1 – 0.68) 72
= 0.872
CFcombination G20, G35 = 0.872 + 0.8 * (1 – 0.872)
= 0.974

Based on the results of manual calculations from the given case examples, it can be concluded that the results of the diagnosis with the greatest possible disease affecting the farmer's chickens is Mareks disease (P12) with a CF value of 0.974 * 100% = 97.4%.

4.5 ANALYSIS OF TEST RESULTS

After experimenting with manually calculating the forward chaining method and certainty factor from the given case examples, it can be concluded that the combination algorithm of the two methods has a good level of accuracy in providing conclusions about chicken diseases based on the symptoms experienced. Furthermore, to find out more about the accuracy of this expert system, a test was carried out using 15 sample data on disease symptoms experienced by laying hens. Accuracy is focused on the similarity of diagnostic results between systems made with expert knowledge. The results of the entire test are shown in Table 4.

Based on the test results with the data in Table 4, it can be concluded that of the 15 samples, 13 produced the same results and 2 different results from the results in the field. The 2 different results have an accuracy value of 36% which indicates that the disease is not necessarily correct or the results can be said to be doubtful, while the test results which have an accuracy value of 86.67% reflect that the disease with the symptoms experienced is appropriate. Therefore the sample test above concludes that the system is capable of producing an accuracy of 86.67% and is said to be feasible by experts. Accuracy Value = 13/15 * 100% = 86.67%.

5 CONCLUSION

Based on the results of tests that have been carried out using 15 data samples, it can be concluded that the forward chaining method combined with certainty factor is able to provide accurate diagnosis results to detect disease in laying hens according to expert interpretation tables with an accuracy value of 86.67%.

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APPENDIX

Table 4 Accuracy Test Results Using Certainty Factor

No	Symptom	Results			Conclusion
		Cf user	System	Expert	
1	1. Decreased appetite 2. Shortness of breath / gasping 3. Wet snoring breath 4. Cough	1. Almost certainly yes 2. Most likely yes 3. Probably yes 4. Sure yes	BAM (100 %)	BAM	S
2	1. Eggs are smaller 2. Paralysis of the cache 3. Bleeding cough	1. Most likely yes 2. Don't know 3. Almost certainly yes	IL (80%)	IL	S
3	1. Diarrhea 2. Egg production decreased	1. Almost certainly not 2. Most likely yes	EDS(41 %)	EDS	S
4	1. There is white dirt stuck around 2. Sudden death	1. Most likely yes 2. Most likely yes	AI (60%)	BK	T
5	1. Growing belly 2. Cluster in the corner of the cage 3. Peck at the cloacal area	1. Almost certainly yes 2. Probably yes 3. Don't know	BA (80%)	BA	S
6	1. Sit with a hunched over 2. Looks sleepy with hair standing up 3. Thin body	1. Almost certainly yes 2. Most likely yes 3. Most likely yes	GD (64%)	BA	T
7	1. Looks lethargic 2. Swollen head 3. Head turning 4. Wings hanging 5. Coarse egg shells	1. Almost certainly yes 2. Probably yes 3. Almost certainly yes 4. Probably not 5. Probably yes	ND (54%)	ND	S
8	1. Discharge from the eyes and nose 2. Greenish-yellow stools 3. Coughing up blood 4. Looks sleepy with hair standing up	1. Sure yes 2. Don't know 3. Probably yes 4. Most likely yes	SA (80%)	SA	S
9	1. There is white dirt stuck around the anus 2. Feces or bloody stools	1. Probably yes 2. Almost certainly yes	BD (80%)	BD	S
10	1. Decreased appetite 2. Shortness of breath / gasping 3. Wet snoring breath 4. Diarrhea	1. Probably yes 2. Probably yes 3. Most likely not 4. Most likely yes	EDS (36%)	EDS	S
11	1. Enlarged belly 2. Wings hanging	1. Don't know 2. Most likely yes	TA (36%)	TA	S
12	1. Peck at the cloacal area 2. Impaired consciousness	1. Almost certainly yes 2. Most likely yes	GD (80%)	GD	S
13	1. Swollen head 2. Sudden death 3. Watery egg whites	1. Most likely yes 2. Sure yes 3. Probably not	AI (100%)	AI	S

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No	Symptom	Results			Conclusion
		Cf user	System	Expert	
14	1. Green diarrhea 2. Looks blue 3. Wattle swelling 4. Pale crest 5. Paralyzed legs and wings	1. Probably yes 2. Probably yes 3. Probably not 4. Don't know 5. Most likely yes	MD (48%)	MD	S
15	1. Sneezes 2. Egg production decreased 3. Sudden death 4. Watery egg whites 5. Sleeping his beak on the floor 6. There is mucus mixed with blood in the oral cavity	1. Almost certainly yes 2. Probably yes 3. Probably not 4. Don't know 5. Probably yes 6. Most likely yes	IL (60%)	IL	S

Information :

S = The same
T = Not the same
BK = Lime stools (Pullorum Disease)
KA = Chicken cholera (Fowl Cholera)
AI = Bird flu (Avian Influenza)
ND = Tetelo (Newcastle Disease)
TA = Typhoid chicken (Fowl Typhoid)
BD = Dysentery (Coccidosis)
GD = Gumboro (Gumboro Disease)
SA = Chicken salesma (Infectious Coryza)
BAM = Chronic chicken cough (Infectious Bronchitis)
BA = Busung chicken (Lymphoid Leukosis)
IL = Coughing up blood (Infectious Laryngotrac)
MD = Mareks (Mareks Disease)
EDS = Egg production (Egg Drop Syndrome 76/EDS 76)