WEB BASED EXPERT SYSTEM DIAGNOSIS OF POULTRY DISEASE WITH CERTAINTY FACTORS METHOD

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ABSTRACT

Pekan Dolok Masihul Pergulaan Chicken Farm is one of the farms located in Serdang Various North Sumatra, this farm has approximately 4500 chickens with details of 1500 hens, and 3,000 male chickens. In raising chickens, which are one of the types of poultry, which are included in the type of livestock whose lives are raised by humans in order to provide economic benefits. In its operation, of course, you have to pay attention to various factors so that this farm can run according to expectations, the factors in question include cleanliness of the cage, type of feed, the amount of feeding and what is no less important is the health of the livestock itself, breeders must be able to recognize various symptoms of disease. In chickens so that the health of the chickens can be maintained properly, this is one of the obstacles in Dolok Masihul Pergulaan Chicken Farm, where breeders have difficulty identifying the symptoms of disease from their livestock. This was done so that there was no big loss. From these problems, the authors make a system that can help breeders in recognizing the symptoms of diseases that occur in poultry.

The purpose of this study was to easily identify the symptoms of disease in poultry, especially in chickens, by utilizing information technology, one of which is the development of an expert system in diagnosing disease symptoms that arise in livestock. The methodology used in developing this expert system uses the Certainty Factor method. With the Certainty Factors method, it can determine the certainty of the diagnosis of a fact that is true or not. This research has several stages, namely problem identification, data collection, system analysis, system design, system implementation, and testing. This research can produce information in the form of symptoms or even diseases arising from livestock, so that farmers can easily use this information as a reference in making a decision, of course the decision in question is the prevention and management of symptoms or diseases that arise in livestock for efforts are made in the form of first aid measures. This system can analyze diseases caused by viruses from the air entered by the user based on the symptoms that exist in poultry. This system is capable of representation storing expert knowledge based on value (Certainty Factor).

Keywords: Website, Expert system, Poultry Diseases, Metode Certainty Factor

I. INTRODUCTION

As animals that are widely consumed by humans, poultry are winged animals that live in groups and can be used for meat, eggs, and feathers. Poultry is very widely raised by humans to meet daily needs as well as improve the economy. Apart from being low in fat, poultry is also suitable for a powerful human diet in terms of nutrition and taste. In raising poultry, humans must maintain the cleanliness of the poultry house and feed the poultry regularly and regularly. Not only that, humans must also pay attention to the health of these birds, starting from recognizing diseases or symptoms that can occur in poultry. This was done so that there was no big loss. From these problems, the authors make a system that can help breeders in recognizing the symptoms of diseases that occur in poultry.

In this era, humans are very spoiled by technology. Technology can help boost the economy. Not only that, technology also increases the speed of information required. Technology has also become a necessity, every job or human activity is not far from computer technology, laptops or cellphones. Technology is used in various businesses, as a means of transactions, entertainment facilities, and information facilities, all of which have been
provided by technology. In the field of animal husbandry, technology is used to simplify, accelerate, and increase overall livestock yield. Technological developments in the field of animal husbandry can help the problems experienced by poultry farmers. By storing sufficient information on reasoning rules, it allows the computer to provide conclusions or decision makers whose quality is in accordance with the ability of a scientific expert in a particular field. One branch of informatics engineering that can support this is expert systems.

Expert systems are needed to solve farmer problems in recognizing the types of diseases and symptoms found in poultry. Expert systems provide consultation on problems that can be breeders. The basic idea is that expertise is transferred from an expert (or other source of expertise) to the computer. The existing knowledge is stored on the computer. Then the farmer can consult related diseases and symptoms of poultry, then the computer provides an explanation and reasons for the farmer. In an expert system, users get information through consultation related to diseases or symptoms that occur in poultry. The user enters the reason, symptoms, and disease in poultry, then the system immediately concludes and explains to the user the problems experienced by the poultry.

Therefore, the authors conducted a study on "Web-Based Expert System Diagnosis of Poultry Disease with Certainty Factors Method" to help breeders at the Pekan Dolok Masihul Pergulaan Chicken Farm - Serdang Bedagai - North Sumatra in breeding poultry on the farm. So that this farm can solve the problem of disease and symptoms of poultry. Also helping to increase production at the Pekan Dolok Masihul Pergulaan Chicken farm - Serdang Bedagai - North Sumatra. Because poultry is one of the most desirable human needs, as well as a promising source of income. Pekan Dolok Masihul Pergulaan Chicken Farm is one of the farms located in Serdang Various North Sumatra, this farm has approximately 4500 chickens with details of 1500 hens, and 3,000 male chickens.

The research method used in this research is the Quantitative Method or more structured, systematic, and planned starting from data collection to making the research design. This research also refers to the stages of system development, namely the system development life cycle (SDLC) concept. Diagram (DFD), and Entity Relationship Diagram (ERD). With the Certainty Factors method, it can determine the certainty of the diagnosis of a fact that is true or not. This research has several stages, namely problem identification, data collection, system analysis, system design, system implementation, and testing. This system can analyze diseases caused by viruses from the air entered by the user based on the symptoms that exist in poultry. This system is capable of representation storing expert knowledge based on value (Certainty Factor).

II. LITERATURE REVIEW

Certainty Factors

Certainty Factor is a strategy in making certainty and simple decisions to make it easier to explain the expert system. The method of certainty factor can be combined with other expert system methods or with decision support system methods so that if the results obtained are good then the results of the decision can be executed and provide recommendations to users (Sudrajat, et al., 2018). With the Certainty Factor method, it can determine the certainty of the diagnosis of a fact that is true or not. With this method, it can produce information in the form of symptoms or even diseases arising from livestock with certain calculations, so that farmers can easily use this information as a reference in making a decision, of course the decision in question is the prevention and management of symptoms or diseases. arises in livestock to make efforts in the form of first aid measures.

\[
CF(Rule) = MB[H,E] - MD[H,E]
\]

\[
MB(H,E) = \left\{ \begin{array}{ll}
P(H) = 1 & \text{lainnya} \quad 1 \\
\frac{\max[P(H|E), P(H)] - P(H)}{\max[1,0] - P(H)} & \\
\end{array} \right.
\]

\[
MD(H,E) = \left\{ \begin{array}{ll}
P(H) = 0 & \text{lainnya} \quad 1 \\
\frac{\min[P(H|E), P(H)] - P(H)}{\min[1,0] - P(H)} & \\
\end{array} \right.
\]

Figure 1. Certainty Factor method
CF (Rule): Certainty factor

MB (H, E): Measure of Belief (measure of confidence) against hypothesis H, if E evidence is provided (between 0 and 1).

MD (HE): Measure of Disbelief (a measure of disbelief) against evidence H, if evidence E is provided (between 0 and 1).

P (H): Probability of the truth of the hypothesis H.

P (H | E): The probability that H is true because of the factor E.

The method above is the Net Belief method proposed by EH Shortliffe and BG Buchanan.

**Expert System**

Expert system is a system that can provide information related to poultry disease. In an expert system, users get information through consultation related to diseases or symptoms that occur in poultry. The user enters the reason, symptoms, and disease in poultry, then the system immediately concludes and explains to the user the problems experienced by the poultry. The expert system itself is made to make it easier for humans. Expert systems are very useful for breeders. Users can find out diseases in poultry, as well as business people can increase the amount of poultry they raise. The expert system is able to analyze and explain the diseases that birds suffer. In the expert system the user can search for a diagnosis to display symptom data related to user consultation regarding poultry diseases and symptoms. Users can see all the symptoms that occur in chickens. In this system, you can also see the disease code. Then there is the history menu to see the history that the user has done, the consultation carried out will go into history so that it can be seen again.

**Data Flow Diagram (DFD)**

DFD (Data Flow Diagram) is a flow or stage of how information data is input to how the information data is stored and the output of the resulting information data. DFD is a process of the data that describes, where are the data coming from, where are the data going out of the system, and then the data will be saved (Wulandari & Widiantoro, 2017). The following are symbols contained in data flow diagrams (DFD): 

<table>
<thead>
<tr>
<th>No.</th>
<th>Symbol</th>
<th>The Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Entitas</td>
<td>To tell you something, for example, a company that produces a jeans, in the process of making jeans requires raw materials that are supplied from other companies.</td>
</tr>
<tr>
<td>2.</td>
<td>Flow of data</td>
<td>To show the data is being done in portrait, the process should be delivered clearly because every process should have the right meaning.</td>
</tr>
<tr>
<td>3.</td>
<td>Process</td>
<td>To show an activity is being done. The process should receive the flow of the data and produce current data.</td>
</tr>
<tr>
<td>4.</td>
<td>Data Store</td>
<td>To show the side-way data can be in form of files or databases from a computer system.</td>
</tr>
</tbody>
</table>

Seen in the picture, the first symbol of DFD is an entity which is defined as an individual or an organization. Then there is data flow as the flow of a process. After that there is a process that converts input to output. Finally,
there is a data store for storing data. Data flow diagrams serve as a description of the building of a system. The flow of the system will be described using a data flow diagram to make it more neat, structured, and easy to understand. By using DFD we can also see the functions of each particular system.

**PHP (Hypertext Preprocessor)**

PHP (Hypertext Preprocessor) is a programming language, part of scripting languages such as JavaScript and Python. The middle business logic tier represents the interface between the presentation layer and the database layer. It is implemented by means of PHP scripts. PHP is an open source language for server side scripting. It is widely used and contains a rich function library code, which makes it ideal for web applications. It is also object oriented so the developed scripts take advantage of object oriented design (Bogunović et al., 2003). PHP can also process data from the server. In making the web for this expert system, MySQL needs to be able to translate the PHP script into a command. By using php, it is very effective and easy to create content.

**MySQL**

MySQL functions to manage data such as usernames, passwords, fonts and so on. MySQL as a database management system uses SQL basic commands. MySQL can be built and installed manually from source code, but it is more commonly installed from a binary package unless special customizations are required. On most Linux distributions, the package management system can download and install MySQL with minimal effort, though further configuration is often required to adjust security and optimization settings (Meqdad & Al Imari, 2020).

### III. METHODOLOGY

The research method used in this research is the Quantitative Method or more structured, systematic, and planned starting from data collection to making the research design. This research also uses the Certainty Factors method. With the Certainty Factors method, it can determine the certainty of the diagnosis of a fact that is true or not. This study also refers to the stages of system development, namely the system development life cycle (SDLC) concept. The design uses the Data Flow Diagram (DFD) model and Entity Relationship Diagram (ERD). Collecting data by conducting observations, conducting research and observing directly at the Pekan Dolok Masihul Pergulaan Chicken Farm - Serdang Bedagai - North Sumatra. Then by gathering information about poultry experts through related journals or articles. After that understand the design of the system that will be implemented. Here are the stages carried out in this study:

![Methodological Flowchart]

**Problem Identification**

Farmers must be able to recognize various symptoms of disease in chickens so that the health of chickens can be maintained properly, this is one of the obstacles in Dolok Masihul Pergulaan Chicken Farm, where breeders have difficulty in identifying disease symptoms from their livestock. This was done so that there was no big loss. From these problems, the authors make a system that can help breeders in recognizing the symptoms of diseases that occur in poultry.

**Data Collection**

Data collection was carried out at the time of research at the Chicken Farm in Pekan Dolok Masihul Pergulaan - Serdang Bedagai - North Sumatra. From 23 September 2020 to 30 November 2020. This research was also assisted by observations and several interviews with workers at the Pekan Dolok Masihul Pergulaan Chicken Farm - Serdang Bedagai - North Sumatra.
System Analysis

Before making the system, the author must first analyze the needs of the system, so that the system created can be used properly according to its function. The analysis carried out refers to the stages of system development, namely the system development life cycle (SDLC) concept. The design uses the Data Flow Diagram (DFD) model and Entity Relationship Diagram (ERD).

System Design

System to be designed must be adjusted to the system analysis carried out previously. Also, make a display system that makes it easier for users to use the expert system.

System Implementation

After the system is designed, it will be implemented, then look again at whether the system has achieved the expected goals. At this stage, it determines that the system is ready for operation.

Testing

At this stage, testing is carried out on the system whether it meets the user's needs. If it is not suitable for use, it will be fixed first according to the desired system.

IV. RESULTS AND DISCUSSION

Results of Data Collection

The following are the results of the collection of disease data.

Chicken disease data

Table 2. Poultry disease data

<table>
<thead>
<tr>
<th>Code</th>
<th>Name of Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>P001</td>
<td>Newcastle Disease (ND) or Tetelo</td>
</tr>
<tr>
<td>P002</td>
<td>H5N1 (Bird Flu)</td>
</tr>
<tr>
<td>P003</td>
<td>CRD (Chronic Respiratory Disease)</td>
</tr>
<tr>
<td>P004</td>
<td>Pullorum Disease (Chalky Powder / White Defecate)</td>
</tr>
<tr>
<td>P005</td>
<td>Coryza (Chicken Colds)</td>
</tr>
<tr>
<td>P006</td>
<td>Cholera</td>
</tr>
<tr>
<td>P007</td>
<td>Typhus (Fowl Typhoid)</td>
</tr>
<tr>
<td>P008</td>
<td>Leucocytozoonosis</td>
</tr>
<tr>
<td>P009</td>
<td>Malaria (Plasmodium gallinaceum)</td>
</tr>
<tr>
<td>P010</td>
<td>Gumboro or Infectious Bursal Disease (IBD)</td>
</tr>
<tr>
<td>P011</td>
<td>Marek (Leukosis Akuta)</td>
</tr>
<tr>
<td>P012</td>
<td>Infectious Bronchitis</td>
</tr>
<tr>
<td>P013</td>
<td>Smallpox or Fowl Pok (FP)</td>
</tr>
<tr>
<td>P014</td>
<td>Dysentery (Coccidiosis)</td>
</tr>
<tr>
<td>P015</td>
<td>Coughing up Blood (Infectious Laryngotracheitis)</td>
</tr>
</tbody>
</table>

In table above, some diseases that often occur in the Chicken Farm of Pekan Dolok Masihul Pergulaan - Serdang Bedagai - North Sumatra are described.

Disease symptoms data

Table 3. Disease symptom data

<table>
<thead>
<tr>
<th>Code</th>
<th>Disease Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>G001</td>
<td>Lethargic and lethargic</td>
</tr>
<tr>
<td>G002</td>
<td>Decreased appetite</td>
</tr>
<tr>
<td>G003</td>
<td>Egg productivity decreases</td>
</tr>
<tr>
<td>G004</td>
<td>Stools look thinner and are green in color</td>
</tr>
<tr>
<td>G005</td>
<td>Distraction</td>
</tr>
<tr>
<td>G006</td>
<td>His corneas look cloudy</td>
</tr>
<tr>
<td>G007</td>
<td>Comb is blue</td>
</tr>
<tr>
<td>G008</td>
<td>The wings are down</td>
</tr>
<tr>
<td>G009</td>
<td>Bleeding evenly on the legs in the form of red spots (ptekhi)</td>
</tr>
<tr>
<td>G010</td>
<td>A clear, thick, exudate discharge from the oral cavity</td>
</tr>
<tr>
<td>G011</td>
<td>Diarrhea</td>
</tr>
</tbody>
</table>
The table above describes the related symptoms that often occur in chickens. The data will be entered into the system as an option in the questionnaire when consulting. In order for users to more easily understand the symptoms that often occur in chickens.

**System Design and Role**

**Data flow diagram (DFD) level 0**
In the picture above, you can see that the system stores disease and symptom data that is input by the admin into the system which will then be displayed on the disease and symptom data display. Admin can not only input data, but can manage data starting from inputting, deleting changes, and adding disease and symptom data. In the flow, it is explained that the user cannot consult before registering or logging in. Therefore, users must register first before consulting. To use the system, the user must first register in order to enter the system. User data will enter into the system and will be stored. If the user has registered and wants to enter the system again, the user must log in first. In the system, the user will do a question and answer with the system related to diseases and symptoms found in poultry. The user selects the symptoms contained in the system and according to the symptoms experienced by ungas, so that the system can provide an explanation regarding these symptoms and diseases and provide ways to overcome them as well as ways of preventing them. The consultation result data will also be entered into the system to be stored and can be viewed again in history.

Data flow diagram (DFD) level 1
Figure 4. Data Flow Diagram (DFD) Level 1

In DFD above, disease data, symptom data and disease results are interconnected, the system can find out and analyze the disease through questions posed to the user. The questions posed are in the form of a questionnaire. The system analyzes the answers from the user during the consultation and then automatically provides data on the diseases and symptoms suffered by poultry, as well as providing ways to overcome and prevent them. It can also be seen that the admin inputs disease and symptom data into the system. Admin can also manage this data.

Data flow diagram (DFD) level 2 of the disease results
In the above dfd, it can be seen that users must fill in their personal data first before entering the system. For users who have registered or filled in their personal data, they can directly log in to the system. Then the system will display a questionnaire page containing several questions related to symptoms and diseases experienced by birds. Users can fill in or answer these questions. Data questions or questionnaires that have been answered will be inputted by the system for analysis. After being analyzed, the system will provide an analysis of the disease or symptoms that occur in poultry. Then display these results to the user. Users can see the results of the consultation which contain data on diseases or symptoms experienced by poultry along with solutions for handling and preventing them. The data that has been analyzed will be automatically stored in the system.

Data flow diagram (DFD) level 2 from the disease

Judging from Figure 6, the admin inputs disease data into the system. Disease data entered by the admin will be processed by the system. The system processes the data and stores it. Then, the system will display the disease data so that it can be seen by the admin and if an error occurs the admin can change the disease data or delete it.

Data flow diagram (DFD) level 2 from the symptom
Judging from Figure 7, the admin inputs symptom data into the system. The data entered by the admin will be processed by the system. The system processes the symptom data and stores it. Then, the system will display the symptom data, so that it can be seen by the admin and if an error occurs the admin can change the symptom data or delete it.

**Entity relationship diagram (ERD) in CDM**

Disease data are correlated with multiple analysis tables; disease codes are in the results analysis table. In order for the system to run, see related disease data with table analysis, symptom data, result analysis and disease table. Some symptom data relate to disease data which means that some symptoms can be a disease. The relationship that occurs in the image is many to many.

**Entity relationship diagram (ERD) in PDM**
Judging from the picture above, each table is related or related. Each table has been explained in detail starting from the disease code, disease name, symptom code, symptom name, date, gender and address. All tables are related to each other to function properly. The relations that occur in the table are many to many so that the table can relate one table to another.

**Interface Design**

The following describes the program flow and usability of the program created along with the design appearance. Below are page views that are in the program being created.

a. Main Page
The picture above shows the main page of the expert system on chickens. Users must register or log in first to the system in order to enter the system and enter the main page. On the main page you can see many menus that can be accessed. Home to display the main page, diagnostics to display symptom data related to user consultation regarding poultry diseases and symptoms. Users can see all the symptoms that occur in chickens. In this view you can also see the disease code. Then there is the history menu to see the history that the user has done, the consultation carried out will go into history so that it can be seen again. Description menu for descriptions of birds and their habitats. There is also an explanation menu about the website. This view can also be accessed by the admin as a data manager for this expert system. For users who do not understand how to use the system, you can search the help menu. In this help display there are steps for using the system such as, how to access the menu, how to do a diagnosis, how to read the description menu, how to view the daily price feature, how to view the consultation history.

b. Diseases symptom Display

On the page of the types of disease symptoms, it is explained about the symptoms of the disease experienced by chickens, ranging from decreased appetite, shortness of breath, sneezing, coughing, dull and wrinkled hair, diarrhea, decreased egg production, chills, looks lethargic, green-green diarrhea, pale, looks blue, swelling, pale comb, paralyzed legs and wings, discharge from the eyes and nose, enlarged stomach, hanging wings, sudden death, rough egg shells, watery egg whites, clustered in the corner of the cage, smaller eggs, thinner and others. Users can see all the symptoms that occur in chickens. In this view you can also see the disease code. The user
can select the appropriate symptom that occurs in chickens and then click select. After selecting the appropriate symptom, the user can view the diagnostic results on the next page.

c. Diseases Diagnosis Results Display

![Figure 12. Diseases Diagnosis Results Display](image)

In the picture above shows an image of the results of the diagnosis that has been done by the user. After selecting the appropriate disease, a diagnosis result page will appear. In this view, it can be seen that the system will display the results in the form of images, there are also details, suggestions, and possible diseases or symptoms that occur in chickens. In the detail view, the details of the disease and its symptoms will be explained, in the suggestions display, suggestions for handling it and also preventing the occurrence of disease or symptoms. In the display of other possibilities, it will explain other possible diseases that will arise if prevention is not done. The results of this diagnosis can also be printed. Users only need to press the print button; the system will print the diagnostic results.

d. Help Page Views
In this view, if the user does not understand how the system works, the user can search for what they need. In this help display there are steps for using the system such as, how to access the menu, how to do a diagnosis, how to read the description menu, how to view the daily price feature, how to view the consultation history. With this menu, users will have no difficulty using the expert system.

e. Page Admin

The image above shows the admin page, which is where the admin must log in first before entering the system. If the username and password are wrong, the admin must fill in correctly, and if appropriate, the admin can enter the system and manage disease data as well as user data and others. Admin can access disease data as well as
consultation history data. If there is a data error, the admin can also change the data. If there is data that is not needed, the admin can also delete the data.

V. CONCLUSION

Conclusion from the results of the research conducted are this system can analyze diseases caused by viruses from the air entered by the user based on the symptoms that exist in poultry. This system is able to represent expert knowledge based on value (Certainty Factor). This disease diagnosis expert system application is made in order to prevent those caused by viruses from air pollution, can diagnose a disease and provide information about its definition, treatment and prevention, so that it can help health experts in dealing with symptoms of the disease. The purpose of this study was to easily identify the symptoms of disease in poultry, especially in chickens, by utilizing information technology, one of which is the development of an expert system in diagnosing disease symptoms that arise in livestock.

This research can produce information in the form of symptoms or even diseases arising from livestock, so that farmers can easily use this information as a reference in making a decision, of course the decision in question is the prevention and management of symptoms or diseases that arise in livestock for efforts are made in the form of first aid measures. Referring to the stages of system development, namely the system development life cycle (SDLC) concept. The design uses the Data Flow Diagram (DFD) model, and the Entity Relationship Diagram (ERD) makes it easier to make the flow of the expert system. By using the application of this poultry diagnosis expert system application, it can be used as an alternative solution for the community to diagnose diseases caused by airborne viruses before consulting directly with health experts.

ACKNOWLEDGEMENT

It is hoped that the application of this expert system is developed so that it can cover more functions, not only a problem of disease, but coupled with the type of suitable food and maintenance procedures from eggs to adult chickens. It is also hoped that the system will be developed into a multiuser application on a mobile basis so that its functions and uses can be widely used by many people anywhere and anytime according to the Operating System on the mobile. And made with methods other than the Certainty Factor method, for example the Bayesian and fuzzy probability methods.

REFERENCES