Expert System for Diagnosing Goat Diseases Using the Forward Chaining Method (Case study of SHQ Nura Farm)

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Abstract—Goats are livestock that provide many benefits for human life, such as meat and milk. Healthy goats will produce quality meat and milk. good so it increases the selling price. Disease can interfere with the growth of goats and if left untreated can kill goats. Most of the farmers still have low knowledge about disease control, whereas goat livestock diseases thrive in tropical climates such as Indonesia. The number of experts available in rural areas is still limited. Information technology such as expert systems can help farmers carry out early treatment of diseases that attack goat livestock. An expert system is a system that tries to adopt human knowledge to a computer, so that the computer can solve a problem as experts usually do. The research here uses the forward chaining method to solve problems that exist in goat livestock. Forward Chaining is a reasoning inference method that uses facts to reach conclusions. The results obtained are in the form of a simple website application to help determine goat diseases and are easy to operate by entering symptom facts of 2 - 3 visible symptoms. The results of the system testing showed 80% accuracy in diagnosing diseases in goats.

Keywords: Disease, Expert system, Forward Chaining, Goat

I. INTRODUCTION

Goat farming is a common commercial practice in Indonesia, especially among rural communities. Goat farming is one of the businesses that can be created in the livestock industry. One of the easiest livestock to care for is goats. Large-scale goat farming can provide income for the community by providing employment [1]. On the other hand, goats are considered savings and can be sold quickly if the farmer needs money, so those who do goat farming on a small scale or as a side business can also benefit the local economy. In terms of commercial development. If kept, goats have a relatively short gestation period compared to other ruminants, and the age of reaching sexual and physical maturity [2].

Goats are livestock that can produce milk, skin, and meat. Goats that are well-raised will produce quality meat, milk, and skin. Because goat meat is popular among various groups, there is a large market demand for it and more people are raising goats for culinary purposes. Most goat farmers sell their livestock at a higher price around big days. The overall health of the livestock is an important consideration when raising goats. This will also have an impact on the eventual selling price of the goats [3].

Many people who raise goats still lack knowledge about the various diseases that their animals may suffer from and how to cure them. Diseases in small goats can be caused by several things, including epidemics,

environmental quality, and maintenance management. Cleanliness of the pen, feed, animal examination, and others are included in maintenance management [4].

Managing health problems in livestock is sometimes made more difficult by farmers' ignorance about the disease. Most farmers rely on firsthand knowledge to solve their goats' health problems. However, sometimes the drugs used to treat the disease actually make it worse. Goat owners are often less aware of the disease that is attacking them [5]. Usually goat owners will immediately slaughter their animals if they are sick or do not recognize the disease. To speed up the treatment of diseases in goats, an expert system is needed to help goat owners identify diseases in their livestock based on existing symptoms [6].

Expert systems are computer programs designed to solve problems according to the opinions of experts. Experts are people who have special knowledge and skills that can solve difficulties that laypeople cannot solve. Expert systems are basically used to help in solving problems[7]. In addition, expert systems can function as a perceptive assistant for an expert. Because expert systems can be used to maintain expert knowledge and competence, farmers can easily identify diseases that attack goats. In addition, expert systems can improve performance and solve problems, thereby reducing decision-making time. The method used to overcome the problem of uncertainty in diagnosing diseases is the Forward Chaining method. Forward Chaining, namely matching symptoms in the form of

questions answered by users with the rules that apply at this time, is how the expert system that will be built diagnoses diseases in goats [8].

This study focuses on the importance of potato plants as one of the main vegetable commodities in Indonesia. Potato plants have a significant role in the agricultural and economic sectors, considering their position as one of the top five vegetable commodities in the country. In the process of diagnosing disease, the tracking method used is forward chaining. This study aims to develop an expert system that can help in diagnosing diseases in potato plants using the forward chaining method. The expert system is able to provide accurate diagnoses based on symptoms reported by users (farmers). By using the forward chaining method, the system can process symptom information. The author conducted this research in the hope that it can help breeders to identify goat diseases and how to treat them[9].

II. RESEARCH METHODS

In writing this research, the author uses data collection techniques by:

1. Interview
    The author asks directly to the authorized parties, especially the livestock section and livestock manager with Mr. Wisnu Aji Wicaksono at SHQ Nura Farm.
2. Observation
    The author conducts direct and focused surveys and observations, so that the author will be able to convey the necessary data or information.
3. Literature Study
    The author collects data and information from various books, journals and various references that are related to the research.

In developing an expert system, a research approach will be used with the ESDLC (Expert System Development Life Circle) method. The stages carried out in the ESDLC method are as follows:

1. Condition Assessment
    Assessment is an important stage as a basis for problems regarding goat diseases by reviewing and limiting the problems to be implemented. The steps taken in this stage are:
    a. Feasibility and Justification of the Problem
        Defining the problem of goat diseases that often occur in livestock farming, in addition explaining the feasibility of selecting a topic that is used as a system for
    b. Objectives of Expert System Development
        Explains the objectives of developing an expert system for diagnosing animal diseases obtained from the previous stage.

c. Needs Analysis
    Analyzing and determining the things needed in developing an expert system for diagnosing goat diseases
d. Knowledge Source
    Explains how to obtain knowledge data about goat diseases and their symptoms.

2. Knowledge acquisition
    In this stage, data collection is carried out, where the data to be used in this study is taken from diseases that have been determined to be used in this study.

Table 1. Disease

Kode	Disease
P1	Bloating
P2	Scabies
P3	Bears
P4	Diarrhea
P5	Worms
P6	Pink Eyes
P7	Mastitis
P8	Have A Cold

3. Design
    The knowledge gained from the knowledge acquisition stage is used in making a design to solve problems in an expert system. In the design stage, a design plan is built.
    1. Flowchart
        is a process flow contained in a program that is used to explain the flow of the application being created. The flowchart can be seen in Figure 1.
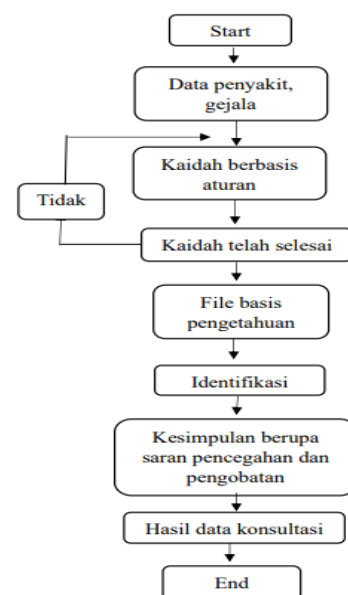

Figure 1. Flowchart

III.   RESULT AND ANALYSIS

1. Basic knowledge of symptoms and diseases

Data Analysis Knowledge obtained from interviews and analysis through books is converted into a table of goat symptoms and diseases. The table of goat symptoms and diseases can be seen in the table below:

Table 2. Disease Symptom Rule

symptom	Disease							
	P1	P2	P3	P4	P5	P6	P7	P8
	bloating	scabies	bears	diarrhea	worms	Pink eyes	mastitis	Have a coold
G01	✓							
G02	✓							
G03	✓							
G04		✓						
G05		✓						
G06		✓						
G07							✓	
G08							✓	
G09								✓
G10								✓
G11				✓				
G12		✓						
G13			✓					
G14				✓				
G15					✓			
G16						✓		
G17							✓	

Information:
G01 The goat appears to be unwilling to eat and is weak.
G02 The goat appears lethargic
G03 The goat appears weak
G04 The goat's skin is crusty
G05 The goat appears to be scratching its body frequently
G06 The goat's fur often falls out
G07 The goat's milk is slightly black
G08 The goat's milk is swollen
G09 The goat's nose is runny
G10 The goat's appetite decreases
G11 The goat's body appears thin
G12 Itchy and often scratches its body
G13 There are scab-like wounds on the lips
G14 The goat is abnormally slow to grow
G15 The goat's feces are watery

G16 The eyes are abnormal or the eyes are gray
G17 The goat's milk is enlarged and the water is purulent.

2. Implementation
The results of the interface implementation or display results of the application that has been created
 a. Login Page
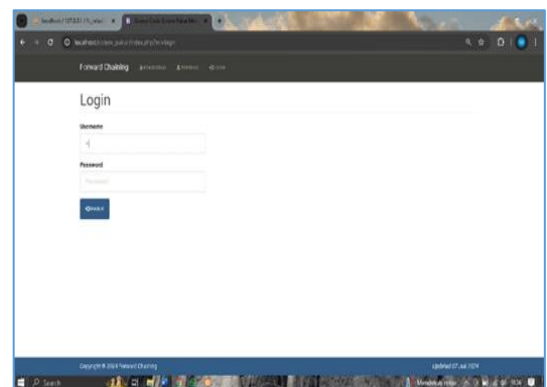The Login page is used for user login, where the user is required to know the user username and password.

Figure 2. Login Page

b. Symptom Page
on this page are symptoms that often occur in goats. the symptoms page can be seen in figure 3.
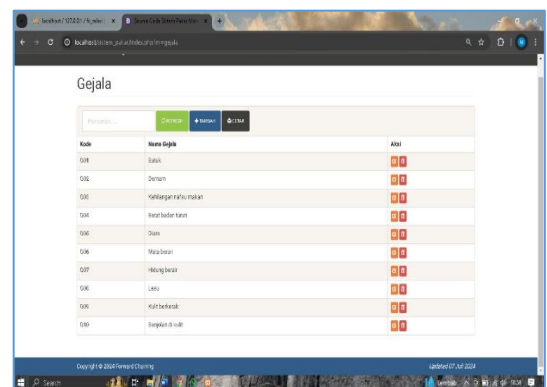

Figure 3. Symptom Page

c. Disease Page
on this page are diseases that often attack goats. the disease page can be seen in figure 4.
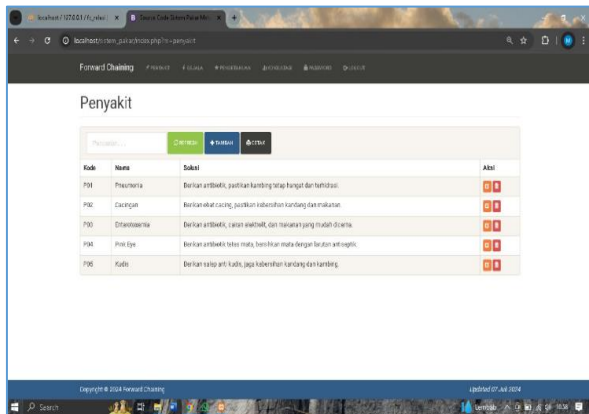
Figure 4. Disease Page

d. Knowledge Menu
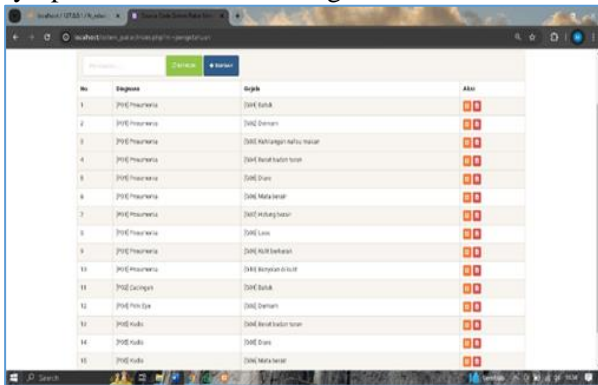   On the knowledge page you can see a list of symptoms. can be seen in figure 5.

Figure 5. Knowledge Menu

e. Consultation Page
    On this page, users can choose what symptoms occur in their goat livestock. After the user has completed the consultation in the form of questions, the user just has to answer Yes or No and so on until the system finds the disease results. On the consultation page, it can be seen in Figure 6.
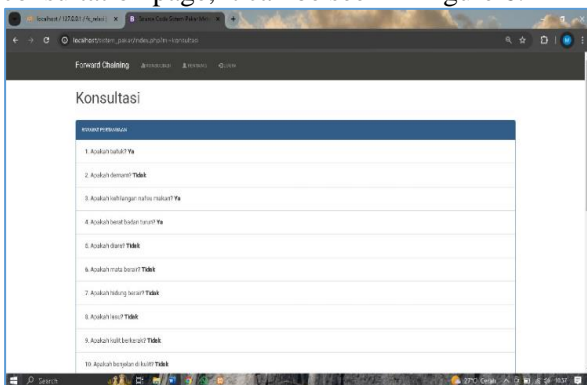

Figure 6. Consultation Page

f. Analysis Results
    On the results page, users can find out about diseases that occur in their goat livestock and solutions to treat them.
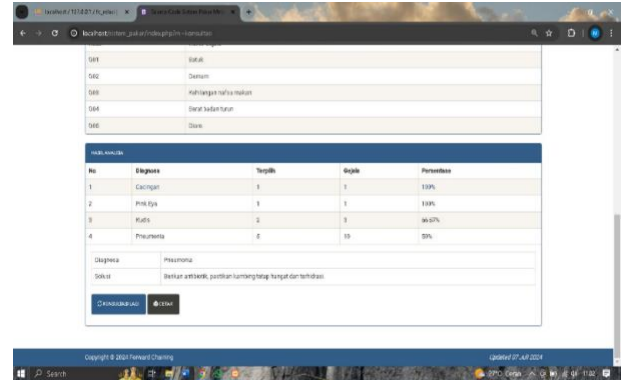

Figure 7. Analysis Results

3. Black Box Testing
    The results of black box testing on an expert system for diagnosing goat diseases using the forward chaining method.

Table 3. Black Box Testing

No	Process Design	Expected Results	Results
1	fill in the login form with username and password	enter the main page	succeed
2	fill in symptom data and save	data appears and is stored in symptom data	succeed
	Click the add data menu	display the add data form	succeed
	click edit data	display data edit form	succeed
3	fill out the disease form and save it	data appears and is stored in disease data	succeed
	Click the add data menu	display the add data form	succeed
	click edit data	display data edit form	succeed
4	click on the knowledge menu	display knowledge data	succeed
5	Click on the consultation menu	select the symptoms that occur	succeed
	click save	display disease analysis results	succeed
6	click the logout menu	back to login menu	succeed

VI. CONCLUSION

Based on the description of the discussion and explanation of the overall materials, there are several things that can be considered for further research development, including:

1. This expert system for diagnosing goat diseases provides benefits to goat owners in the consultation process.
2. With the expert system for diagnosing diseases in goats using the Forward Chaining method, goat farmers can solve the problem by displaying the diagnosis results quickly and accurately based on the symptoms entered.

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