International Journal Of Health, Engineering And Technology (IJHET) *E-ISSN 2829 - 8683*
Volume 3, Number 3, September 2024, *Page. 833 - 843*
Email : editorijhess@gmail.com

Application Case Based Reasoning Method In Diagnosing Oil Palm Plant Diseases At PT Rapala, Gebang Sub-District

Hafizah Husna [1*)], Hotler Manurung [2)], Arnes Sembiring[3)]
[1,2,3)] STMIK Kaputama Binjai, Indonesia

*Corresponding Author
Email : hafitzahhusna27@gmail.com

Abstract

In the last five years, the development of computers is very rapid. This can be seen from the number of computers owned by the community, with various sophistication and features and information systems that can spoil its users. One area of application that can be considered is the field of diagnosing oil palm plant diseases. Difficulties in diagnosing oil palm plant diseases at PT. RAPALA Kec. Gebang often occurs when you want to take preventive or curative action when an oil palm plant is attacked by a disease, because the old diagnostic system is due to limited experts so that the quality of operational performance is lacking. With the application of an expert system in diagnosing oil palm plant diseases, it is hoped that it will make it easier for field workers to diagnose oil palm plant diseases quickly without waiting for experts. This system is designed using PHP My Admin programming software and MySQL as database. The result of this study is the process of diagnosing diseases in oil palm plants using the Case Based Reasoning method where the design begins with entering symptom data, then the system calculates the diagnostic results according to the Case Based Reasoning method and displays it in the form of a report.

Keywords: Case Based Reasoning, Oil palm plantation

INTRODUCTION

Indonesia is an agricultural country and agriculture is one of the factors of the Indonesian economy. Currently, the agricultural sector still provides income for most households in Indonesia. In 2013 the agricultural sector contributed 14.43% of the national GDP, a slight decrease compared to the previous decade (2003) which reached 15.19% in 2012, this sector provides jobs for around 49 million people in Indonesia representing 41% of the total workforce in this country.

One of the factors that affect or can reduce oil palm growth and productivity is the presence of plant diseases which can be from physical symptoms such as leaves, stems, roots, or from the fruit of the oil palm produced. This is one of the factors that can cause crop failure in oil palm plants or the lack of quality value in oil palm fruit.

PT. Raya Padang Langkat (PT. RAPALA) is a private company that produces crude oil. In diagnosing diseases in oil palm plantations at PT RAPALA plantations, it is done by checking the plants only with a few experts in agriculture, this causes the diagnosis process to take a long time because the number of experts is limited, resulting in frequent delays in overcoming diseases in plants. palm.

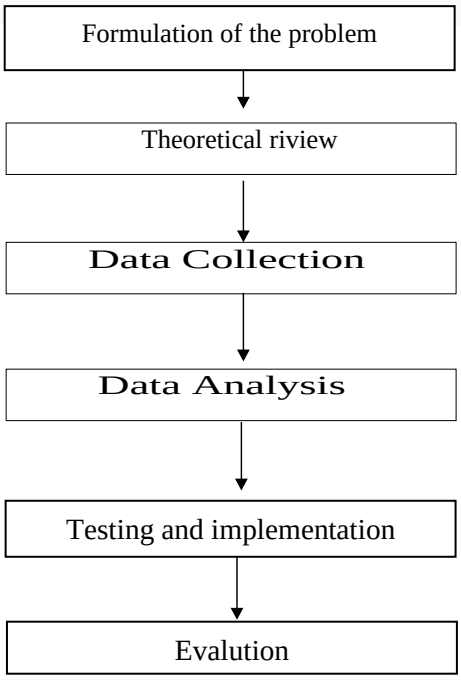
the objectives of this research are as follows:

1. To diagnose oil palm plant diseases using Case Based Reasoning method.
2. To make it easier for field workers to find out diseases of oil palm plants quickly.

According to the journal Sidauruk Acimah and Ade Pujito (2017) Expert systems are computer systems that match the ability of an expert in decision making. The word equal means that the expert system is expected to work in all respects like an expert. Expert system is a branch of artificial intelligence (artificial intelligence) that makes extensive use of and specialized knowledge to solve human-level problems who are experts in certain fields.

RESEARCH METHODS

Based on the methodology carried out in this study, a flow of research work method activities was formed in Figure 1.



Picture 1. Research Workflow

Based on the picture above, it can be explained that there are several stages used in making this application program, namely as follows:

1. Problem Formulation

This stage is the initial stage of research, namely by determining the background of the problem, objectives, and benefits of the research carried out by limiting the problem so that it does not get out of the focus of the discussion or thesis preparation.

2. Theory Study

This stage is to find information, sources related to the problems faced, both from literature studies, journals and the internet as a support and basic foundation for thesis writing.

3. Data Collection

This stage intends to collect research data such as symptoms and diseases of cholecystitis obtained from literature studies such as journals and books, observations and interviews with experts. Then the data for the Dempster Shafer method were obtained from journals and books.

4. Data Analysis

Data analysis is a process or effort to process data into new information so that the characteristics of the data become easier to understand and useful for solving problems, especially those related to research. At this stage, data analysis will be carried out using the Dempster Shafer method, the data will be calculated so that the results of the diagnosis of cholecystitis will be obtained.

5. Testing and Implementation

This stage performs validation testing and implementation of the previously analyzed data and program preparation.

6. Evaluation

This stage draws conclusions and suggestions that can be made in the preparation of the thesis. With the conclusion, the results of the entire thesis will be known and it is hoped that with suggestions there will be improvements and other benefits.

In addition, the author also calculates using accuracy, the accuracy value in question is to determine the percentage of accuracy in the classification process for the tested data, the level of accuracy is calculated by the formula:

$$T \qquad Si = \frac{\sum_{t=1}^{n} W \, Si \, (\int T \int S)}{\sum_{t=1}^{n} W}$$

Case Based reasoning method

Case Based reasoning method is one method to build a system by making decisions from new cases based on solutions from previous cases. The concept of the Case Based reasoning method was found from the idea of using documented experiences to solve new problems.

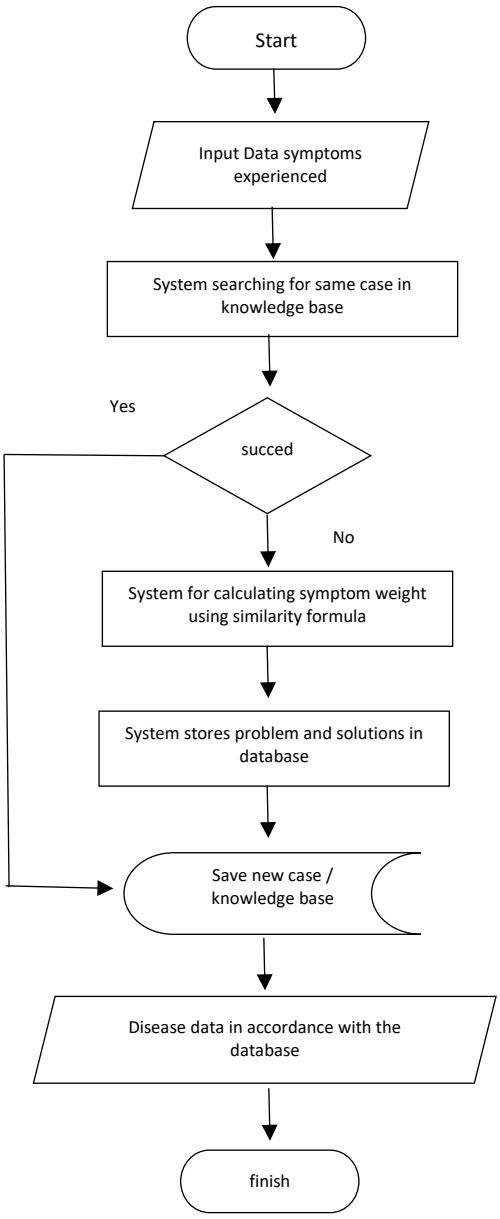
The decision makers mostly use experiences from previous problem solving to solve the problems they face today. If there is a new case, it will be stored in the knowledge base so that the system will learn and the knowledge possessed by the system will increase. In general, this method consists of four steps, namely:

a. Retrive, get / get back the case that is most similar / relevant (similar) to the new case. This retrieval stage begins by describing/describes part of the problem, and ends when a match is found to the previous problem with the highest level of match.
b. Reuse, modeling/reusing old case knowledge and information based on the most relevant similarity weights into new cases, resulting in proposed solutions where an adaptation to the new problem may be needed.
c. Revise, reviewing the proposed solution then testing it in real cases (simulation) and if necessary improving the solution to match the new case.
d. Retain, integrate/save new cases that have succeeded in getting a solution so that they can be used by subsequent cases similar to the case.

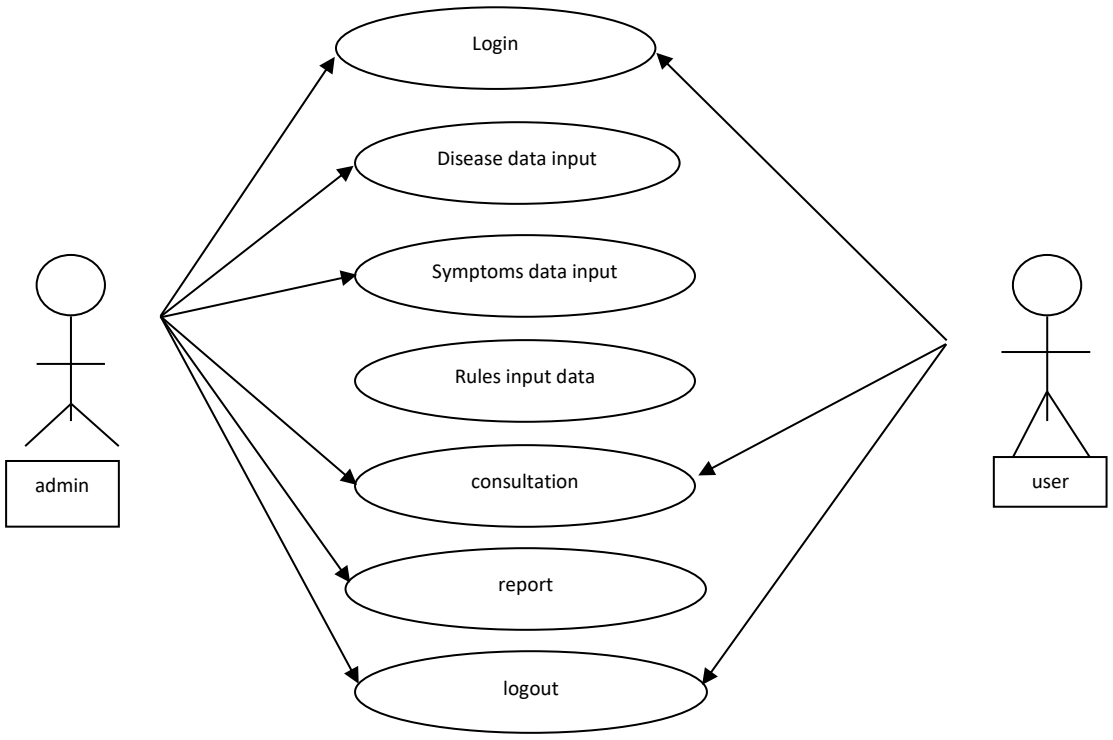
System planning

In designing an expert system to diagnose oil palm plant diseases, the author uses the Case Based Reasoning method to solve the problem. The design of this system includes:.

Disease Diagnosis Flowchart



Picture 2. Disease Diagnosis Flowchart



Picture 1 Use Case Diagram

RESULTS AND DISCUSSION

In this study, research data is needed to be calculated using the Case Based Reasoning method.

Table 1. Data on Diseases of Oil Palm Plants

Code	Disease Name
P01	Root rot
P02	Destroyed
P03	Rotten Bunches
P04	Leaf Corat

Table 2. Data on Disease Symptoms of Oil Palm Plants

Code	**Symptom**
G01	Decay at the base of the stem
G02	Yellowing Leaves
G03	Leaves and midribs dry up
G04	Spear leaf accumulation
G05	Hanging midrib
G06	Falling tree
G07	Decay in the middle

G08	Broken
G09	Experiencing decay
G10	Give off bad smell
G11	Contains a slimy white bacterial mass
G12	Easy to remove
G13	Maldives palmivorus fungal infection
G14	Bunches of rotten bottom
G15	Young bunches infected with malasmiun palmivorus
G16	Mycelium and fruiting bodies of malasmiun palmivorus grow on bunches
G17	Red sheath

Table 3. Base Rule

No	Symptoms	P1	P2	P3	P4
G01	Decay at the base of the stem	√			
G02	Yellowing Leaves	√	√	√	√
G03	Leaves and midribs dry up	√	√	√	
G04	Spear leaf accumulation	√			√
G05	Hanging midrib	√			√
G06	Falling tree	√			
G07	Decay in the middle	√			
G08	Broken		√		
G09	Experiencing decay	√	√		√
G10	Give off bad smell	√	√	√	√
G11	Contains a slimy white bacterial mass	√	√	√	√
G12	Easy to remove	√	√		
G13	Maldives palmivorus fungal infection			√	
G14	Bunches of rotten bottom		√	√	
G15	Young bunches infected with malasmiun palmivorus			√	
G16	Mycelium and fruiting bodies of malasmiun palmivorus grow on bunches			√	
G17	Red sheath	√	√	√	√

Application of the Method

The data needed in the expert system analysis process to diagnose oil palm plant diseases using the case based reasoning method is pure data obtained from interviews by experts at PT. RAPALA by taking diseases and symptoms that are often experienced by oil palm plants at PT RAPALA.

Table 4. Rule Base (*Rule*)

No	Disease Name	Symptoms
P01	Root rot	Have Symptoms: - Decay at the base of the stem - Yellowing Leaves

		- Leaves and midribs dry up - Accumulation of spear leaves - Hanging midrib - Falling tree - Decay in the middle - Experiencing decay - Give off an unpleasant smell - Contains slimy white bacteria mass - Easy to remove
P02	Destroyed	Have Symptoms: - Yellowing Leaves - Leaves and midribs dry up - Remove broken - Experiencing decay - Give off an unpleasant smell - Contains slimy white bacteria mass - Easy to remove - Bunches of rotten bottom - Red sheath
P03	Rotten Bunches	Have Symptoms: - Red sheath - Give off an unpleasant smell - Contains slimy white bacteria mass - Maldives palmivorus fungal infection - Bunches of rotten bottom - Young bunches infected with malasmiun palmivorus - Mycelium and fruiting bodies of malasmiun palmivorus grow on bunches - Yellowing Leaves - Leaves and midribs dry up
P04	Leaf Corat	Have Symptoms: - Yellowing Leaves - Accumulation of spear leaves - Hanging midrib - Experiencing decay - Give off an unpleasant smell - Contains slimy white bacteria mass - Red sheath

Table 5. User Value

No	Information	Score
1	Yes	1
2	No	0

A value of 0 indicates that the consultation user informed that the oil palm plant did not experience symptoms as asked by the system, while a value of 1 indicated that the consultation user informed that the oil palm plant had symptoms as stated by the system.

Each symptom has a weight that indicates the level of importance to oil palm disease. The greater the weight value, the more important the symptom is to determine the type of disease. The first step, the expert determines the CBR value for each symptom, namely:

Table 6. Weights based on each symptom

No	Informations	Score
1	Decay at the base of the stem	5
2	Yellowing Leaves	1
3	Leaves and midribs dry up	3
4	Spear leaf accumulation	3
5	Hanging midrib	3
6	Falling tree	5
7	Decay in the middle	5
8	Broken	5
9	Experiencing decay	3
10	Give off bad smell	1
11	Contains a slimy white bacterial mass	1
12	Easy to remove	3
13	Maldives palmivorus fungal infection	5
14	Bunches of rotten bottom	3
15	Young bunches infected with malasmiun palmivorus	5
16	Mycelium and fruiting bodies of malasmiun palmivorus grow on bunches	5
17	Red sheath	1

Description of symptom weight:

Main symptom = 5
Companion symptom = 3 & 1

The weight value is obtained from the similarity of symptoms between diseases where if a symptom in a disease has no resemblance to another disease then it is determined as an important symptom (main symptom) and hereby the expert gives a weight value of 5, then if a symptom in a disease have similarities with 2 to 3 types of disease, then the symptom is designated as a fairly important symptom (companion symptom), hereby the expert gives a weight value of 3, but if a symptom has similarities with all diseases then the symptom is designated as an unimportant symptom (symptom companion) and hereby the expert gives a weight of 1, because it is considered that these symptoms can occur in every disease.

Then proceed with determining the approach in finding the similarity of two cases by calculating the closeness between the new case and the old case. The calculation of the size of the similarity between the old case (source case) and the new case (target case) uses the similarity method. The calculation is based on the matching of the weights of a number of features that are owned by both cases. The basis of this technique is to compare each target case attribute with each attribute in the source case in the base case, then the comparison is calculated using the similarity function as follows:

Table 7. Base rot cases (P1)

No	Symptoms	Score
G01	Decay at the base of the stem	5
G02	Yellowing Leaves	1
G03	Leaves and midribs dry up	3
G04	Spear leaf accumulation	3
G05	Hanging midrib	3
G06	Falling tree	5
G07	Decay in the middle	5
G09	Experiencing decay	3
G10	Give off bad smell	1
G11	Contains a slimy white bacterial mass	1
G12	Easy to remove	3

Table 8. Case Base of Pupus Rot Disease (P2)

No	Symptoms	Score
G02	Yellowing Leaves	1
G03	Leaves and midribs dry up	3
G08	Broken	5
G09	Experiencing decay	3
G10	Give off bad smell	1
G11	Contains a slimy white bacterial mass	1
G12	Easy to remove	3
G14	Bunches of rotten bottom	3

Table 9. Case Base of Bunch Rot Disease (P3)

No	Symptoms	Score
G03	Leaves and midribs dry up	3
G02	Yellowing Leaves	1
G10	Give off bad smell	1
G11	Contains a slimy white bacterial mass	1
G12	Maldives palmivorus fungal infection	5
G14	Bunches of rotten bottom	3
G15	Young bunches infected with malasmiun palmivorus	5
G16	Mycelium and fruiting bodies of malasmiun palmivorus grow on bunches	5
G17	Red sheath	1

Table 10. Case Base of Leaf Corrat Disease (P4)

No	Symptoms	Score
G02	Yellowing Leaves	1
G04	Spear leaf accumulation	3
G05	Hanging midrib	3
G09	Experiencing decay	3

G10	Give off bad smell	1
G11	Contains a slimy white bacterial mass	1
G17	Red sheath	1

Consultation testing was carried out on oil palm plants with symptoms including:

Table 11. New Case Consultation Data

No	Symptoms	Score
G02	Yellow leaves	1
G04	Spear leaf accumulation	3
G10	Give off bad smell	1
G11	Contains a slimy white bacterial mass	1
G13	Maldives palmivorus fungal infection	5
G14	Bunches of rotten bottom	3
G15	Young bunches infected with malasmiun palmivorus	5
G17	Red sheath	1

From the consultation data, a CBR process will be carried out for base rot disease (P1), with the following formula:

$$T \qquad Si = \frac{\sum_{t=1}^{n} W.Si\ (\int T\ \int S)}{\sum_{t=1}^{n} W}$$

$$T \qquad Si = \frac{(0*5)+(1*1)+(0*3)+(1*3)+(0*3)+(0*5)+(0*5)+(0*3)(1*1)(1*1)+(0*3)}{5+1+3+3+3+5+5+3+1+1+3} = 0{,}18$$

From the consultation data, a CBR process will be carried out for pupal rot disease (P2), with the following formula:

$$T \qquad Si = \frac{\sum_{t=1}^{n} W.Si\ (\int T\ \int S)}{\sum_{t=1}^{n} W}$$

$$T \qquad Si = \frac{(1*1)+(0*3)+(0*5)+(0*3)+(1*1)+(1*1)+(0*3)+(0*3)}{1+3+5+3+1+1+3+3} = 0{,}15$$

From the consultation data, the CBR process for bunch rot disease (P3) will be carried out with the following formula:

$$T \qquad Si = \frac{\sum_{t=1}^{n} W.Si\ (\int T\ \int S)}{\sum_{t=1}^{n} W}$$

$$T \qquad Si = \frac{(0*3)+(1*1)+(1*1)+(1*1)+(1*5)+(1*3)+(1*5)+(0*5)+(1*1)}{3+1+1+1+5+3+5+5+1} = 0{,}68$$

From the consultation data, the CBR process for leaf rust disease (P4) will be carried out with the following formula:

$$T \qquad Si = \frac{\sum_{t=1}^{n} W.Si\ (\int T\ \int S)}{\sum_{t=1}^{n} W}$$

$$T \qquad Si = \frac{(1*1)+(1*3)+(0*3)+(0*3)+(1*1)+(1*1)+(1*1)}{1+3+3+3+1+1+1} = 0{,}53$$

From the calculation process in new cases using the CBR method, the results of the recommended values are as follows:

Table 12 Recommended Values

Code	Disease Name	Score
P1	Root rot	0,18
P2	Destroyed	0,15
P3	Rotten Bunches	0,68
P4	Leaf Corat	0,53

From table 12, the oil palm plants calculated using the CBR method are affected by bunch rot disease with a recommended value of 0.68 or 68%.

CONCLUSION

From the results of research to diagnose oil palm plant diseases using the case based reasoning method, it can be concluded that:

1. The case based reasoning method can be applied to diagnose oil palm plant diseases so that it can help field workers to diagnose oil palm plant diseases quickly.
2. With this expert system, based on the accuracy that has been calculated using the case based reasoning method, the percentage is 68%.
3. There are facilities for admins or experts to manage articles related to this disease, so that after this research is completed, the data can be managed and developed.

REFERENCES

Arhami, M. (2005). Arief, M. (2007). Konsep Dasar Sistem Pakar. Andi: Yogyakarta *Mengidentifikasi Penyakit Tanaman Sawit*. *x*, *No.x*(x), 1–5.

Arief, M. Rudianto. 2011. Pemrograman Web Dinamis Menggunakan PHP dan MySQL. Yogyakarta. Andi Offset

Rika Rosnelly (2012), Sistem Pakar Konsep Dan Teori. Yogyakarta : Penerbit CV. ANDI OFFSET

Wendra, Y., Alwendi, Ardi, & Aldo, D. (2020). Metode Case Based Reasoning Untuk Identifikasi Penyakit Tanaman Padi. *Jursima*, *8*(2), 103–110. https://ejournal.stmikgici.ac.id/index.php/jursima/article/view/8-2-6