



Application of an Expert System for Disease Identification in Rice Plants Using the Certainty Factor Method

Naufal Irwan

Informatics Engineering, Faculty of Science and Technology, Maulana Malik Ibrahim State Islamic University Malang

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ABSTRACT

Rice disease is a biotic stress that can reduce yields and can even cause crop failure. Therefore, to get optimum yields in rice cultivation, it is necessary to control disease. Disease is controlled with an Integrated Disease Management (IPM) approach which is integrated into the PTT model. The lack of experts is also a constraint on agriculture. An expert system application is needed to replace the shortage of experts. The application of an expert system for identifying diseases in rice plants applies the Certainty Factor method in determining the identification results. Several supporting tools are also used, such as PHP as a programming language, MySQL as a database, and XAMPP as a local server. The results of functional testing on the application have been running 100% and the calculation of the level of validity of the results is in accordance with the results of the experts. In user testing, 82.67% said it was good, 14.67% said it was sufficient, and 2.67% said it was not enough. Based on these results, the application of an expert system for identifying rice plant diseases has been well received.

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Corresponding Author:

Nufal Irwan,
Informatics Engineering Faculty of Science and Technology
Maulana Malik Ibrahim State Islamic University Malang
Email: irwan.naufal@gmail.com

1. Introduction

Diseases can affect living things, both humans and plants, this disease in rice plants causes commodity production to decrease every year. Based on data from the Central Statistics Agency (BPS) catalog, rice production in 2014 (ASEM) was 70.83 million tons of milled dry grain (GKG) or decreased by 0.45 million tons (0.63 percent) compared to 2013. The decline in rice production in 2014 occurred on the island of Java amounted to 0.83 million tons, while the production of rice outside.

Java Island experienced an increase of 0.39 million tons. The decline in production is estimated to occur due to a decrease in harvested area of 41.61 thousand hectares (0.30 percent) and a decrease in productivity of 0.17 quintals/hectare (0.33 percent). The decrease in rice production in 2014 of 0.45 million tons (0.63 percent) occurred in the January–April and May–August subrounds of 0.83 million tons (2.56 percent) and 0.22 million tons, respectively (0.94 percent), which was due to disease, while in the September–December subround, rice production increased by 0.60 million tons (3.74 percent) compared to production in the same subround in 2013 (year-on-year). Constraints to increase production will be more complex due to global climate change which causes unstable production.

In Southeast Asia, the average yield of rice is 3.3 tons/ha, whereas the average yield is 5.6 tons/ha. The yield gap was caused by disease by 12.6% and pests by 15.2% (Oerke et al. 1994). In

Indonesia, the yield potential of released rice varieties ranges from 5-9 tons/ha (Suprihanto et al. 2006), while the national yield has only reached an average of 5.32 tons/ha (BPS ; 2013). The problem identification process has difficulties in detecting the many symptoms so that it takes quite a long time, the lack of knowledge or insight of a farmer about knowledge of rice diseases, the amount of costs that must be incurred because it requires an agricultural expert. The problems faced by farmers as a result of this disease, then we need a service that can help farmers to diagnose early disease in their rice plants in the form of an expert system. (expert systems). The expert system with the Certainty Factor method is applied using the PHP (Hypertext Preprocessor) programming language and the Database Management System (DBMS) using MySQL.

Decision making on an expert system can use the Certainty Factor method. In the Certainty Factor method, decision making starts from tracing all data and rules to achieve the goal. The Certainty Factor method is suitable to accommodate the uncertainty of an expert's thinking about the disease with the characteristics of the symptoms suffered. From this explanation, this expert system can be applied to help farmers solve the problems they face due to diseases that affect their rice plants. Because the expert system can identify rice plant diseases from the existing symptoms and provide solutions based on the type of disease like an expert.

2. Method

2.1 Method of collecting data

a. Study of literature

In this method, the author will conduct a search, learn from various kinds of literature and documents related to the application of an expert system to identify diseases in rice plants.

b. Observation

Observing the data studied, conducting interviews with parties related to the application of an expert system for identification of diseases in rice plants, namely farmers, agricultural experts, lecturers and students of the agricultural faculty of the University of Muhammadiyah Malang.

c. Browsing

Make observations to various websites on the internet.

d. Analysis of the data that has been collected

Make an analysis of the data that has been obtained from the results of observations by combining it with survey reports and user policies into a structured specification.

e. App design and design

Understand the design of the application for identification of diseases in rice plants according to existing data and implement the model desired by the user.

3. Results and Discussion

In the disease identification process, it is necessary to calculate the CF value of a disease based on the symptoms entered. The flow of the Certainty Factor calculation can be seen in Figure 1 below:

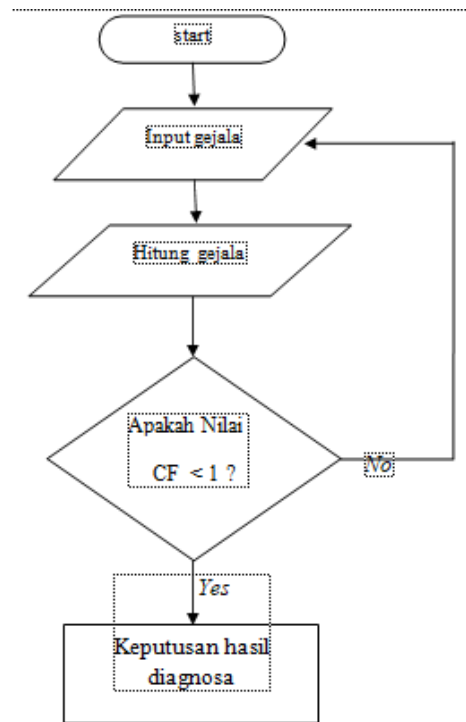


Figure 1. Certainty Factor Flowchart

Knowledge from an expert must be represented in a certain form or format which is then collected in a knowledge base (Knowledge Based). The knowledge base consists of 2 basic elements, namely facts which are information about objects in a particular problem area and rules which are information about how to how to obtain new facts from known facts.

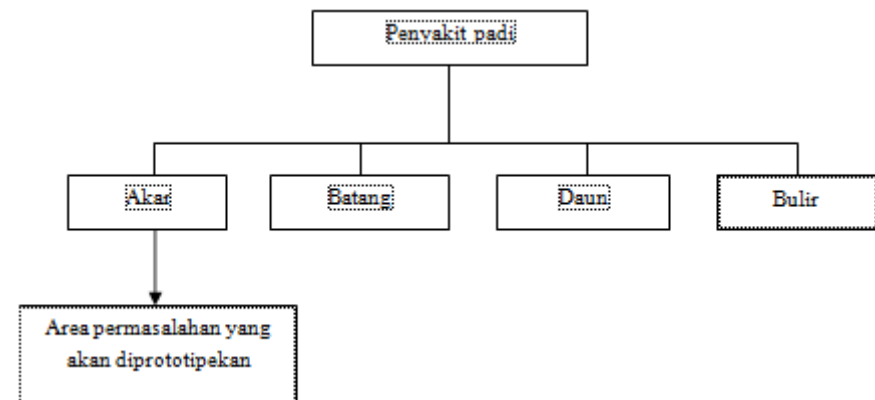


Figure 2. Problem Area Block Diagram

The problem focus block diagram is used to explain the decision making situation for the identification of rice plant diseases. In the block diagram of the focus of this problem, there is a problem, namely rice diseases that attack rice plants. The block diagram of the focus of the problem can be seen in Figure 3 below:

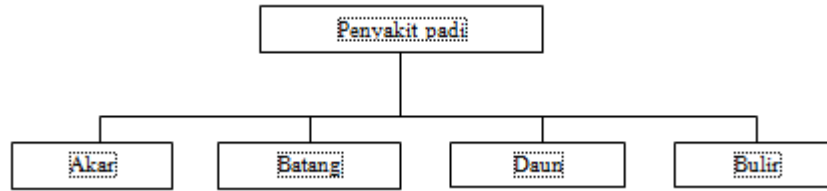


Figure 3. Problem Focus Block Diagram

The block diagram of the crisis factor is a critical factor that influences the outcome of the decision. In this application, the thing that matters is the symptom factor. Symptoms are used as a basis for decision making to identify the type of rice disease that is attacking rice plants and how to deal with them. The block diagram of the crisis factor can be seen in Figure 4 below:

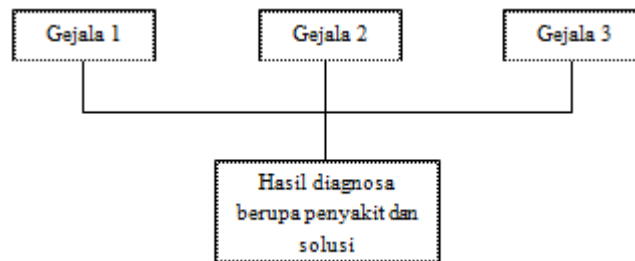


Figure 4. Crisis Factor Block Diagram

a. Homepage

The home page is the initial display of the application of an expert system for identifying diseases in rice plants when the program is run. This page contains an explanation of rice. The implementation of the home page can be seen in Figure 5 below:



Figure 5. Homepage

b. Disease Info Page

The Disease Info page is a page that contains information on diseases in rice plants and explanations of the disease. The implementation of the Disease Info page can be.



Figure 6. Disease Info Page

c. Diagnosis Page

The Diagnosis page is a page used by the user to diagnose rice plant diseases by entering the symptoms suffered by rice. The implementation of the Diagnosis page can be seen in Figure 7 below.



Figure 7. Diagnosis Page

d. Help Page

Help page is a page used by users to find out how to use an expert system application to identify diseases in rice plants. The implementation of the Help page can be seen in the following figure 8;



Figure 8. Help Page

e. Diagnostic Results Page

The Diagnosis Results page is a page that contains the results of the diagnosis of rice plant diseases based on the symptoms entered by the user. The results displayed are the name of the disease and the level of confidence in the disease written in percent as well as solutions that can be used to treat the disease. The implementation of the diagnostic results page can be seen in Figure 9 below;



Figure 9. Help Page

4. Conclusion

The conclusion that can be drawn from the Application of the Expert System for Diagnosing Rice Diseases using the Certainty Factor Method is that it has been completed as a solution to the problem formulation raised, namely building an expert system application that can be used to determine the type of disease in rice plants based on the symptoms given and which can provide solutions for the treatment of diseases that attack rice plants.

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