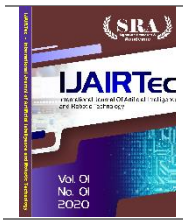

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EXPERT SYSTEM FOR DIAGNOSING DISEASES IN BETTA FISH BASED ON ANDROID

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Abstract
Betta fish are in demand and bred by the community. Based on their habitat, betta fish are in swamps, rivers, and lakes. In Indonesia, many are found in various areas such as Kalimantan, Sumatra and others. Betta fish is one of the freshwater fish which has its own uniqueness and many types, both in terms of color and shape. Some of them have bright, dark and exotic colors. Many novice breeders of betta fish are just starting their business and they find it difficult when their pet betta fish get sick. Diseases found in ornamental fish, especially betta fish, are more quickly prevented and treated if the Betta fish cultivators know in advance what diseases are attacking their fish. Therefore, a research is needed which makes it easier for novice breeders of betta fish to find out early about what diseases attack their fish before they jump into betta fish breeders. This method used the forward chaining method. In order for betta fish farmers to detect diseases more quickly, we tried to create a program to detect betta fish diseases using an expert system. This expert system also aims to provide preventive solutions to these fish so that breeders can get a satisfactory harvest. It also diagnoses diseases in fish. After these symptoms are detected, the disease, symptoms and treatment will be found.

I. INTRODUCTION

Betta fish are fish which live in fresh water, which are often encountered in swamps, lakes, rivers. Betta fish have their own interests. Betta fish is one type of ornamental fish which has its own uniqueness compared to other ornamental fish. The uniqueness in question is his penchant for fighting with fellow betta fish and fish

which are commensurate with him. The aggressiveness of betta fish is very high so it is not recommended to combine or mix these types of fish into one place (Gumilang et al. in the journal Wahyu Dewantoro, 2017). This is to reduce quarrels between fellow fish. A study was conducted by Fadhil (2019) with the title "Creating an Expert System Application to Diagnose a Disease in Betta Fish using the Naive Bayes Method". This research is intended to find an application which can help ornamental fish breeders using the methodology (ESDLC). The Naive Bayes method is a Bayesian probability theory from a mathematical statistical theory which uses an uncertainty model of an event which occurs by combining general knowledge, research and facts from observations. To perform testing on this expert system, we can use the black box testing method, which focuses on the functional requirements of the expert system and the features of the disease diagnosis results which will result in an expert system which can diagnose diseases in betta fish and their treatment solutions[1]. The second study was conducted by Budi (2017) with the title "Combination of Forward Chaining and Certainty Actor Methods to Diagnose Diseases in Betta Fish." This system can also be concluded that this system can be used for the next generation[2]. The third study was conducted by Siregar (2018) with the title "Masculinization of Betta Fish Using Natural Medicines through the Immersion Method." Masculinization of betta fish larvae using natural honey 6 ml/L through immersion method for 24 hours can have a significant effect on male betta fish fertilization and survival percentage during immersion, but has no significant effect on survival percentage during maintenance. In this study, the P4 treatment with 24 hours of immersion resulted in the highest percentage of male betta fish, which was 85.14%. Water quality, temperature was 27.55oC, pH 5.85, DO 3.55 mg/L and ammonia 0.0015 mg/L[3].

In diagnosing betta fish disease, cultivators must properly look at the whole fish so that we can determine whether the fish is really affected by the disease or not. This is usually difficult to identify because there are usually many betta fish which don't look sick but in fact they have a disease which can infect other betta fish in the same place. This research can be used as a basis for consideration in making an expert system application to diagnose symptoms and treatment in betta fish using android. Expert system uses inference reasoning like an expert in solving problems. An expert system for diagnosing betta fish disease is a great solution for publicizing betta disease and how to treat it.

II. LITERATURE REVIEW

2.1. Expert system

Expert systems are systems which seek to adopt human knowledge to computers so that computers can solve a problem as it is usually done by experts. A good expert system is designed to be able to solve a problem by imitating the performance of experts[4]–[6]. With this expert system, even ordinary people can solve difficult problems which can only be solved by using the help of experts. For experts, these expert systems will also be very helpful in their activities as assistants who are very experienced in their fields[7], [8].

Expert systems are often defined as artificial intelligence groups which have special abilities to solve an existing problem. This research is based on intelligent

research (android applications). An expert system is a computer program which solves a problem using rules and facts. Furthermore, it makes rules to map all the facts which exist according to the needs of the expert system. Through the existing rules, we can lead to solving a problem more easily based on facts or findings of existing problems so as to produce a good decision (Figure 1).

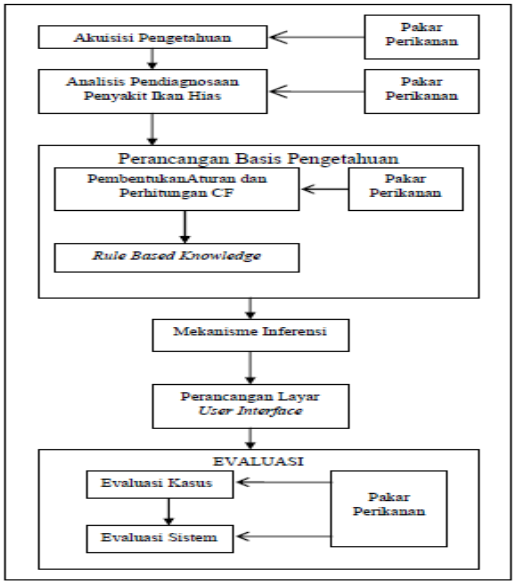

Figure 1. Design of an Expert System in Diagnosing Betta Fish Disease

2.2. Betta fish

The male betta fish has a more beautiful body and pattern and has a better selling price than the female. Male betta fish tend to be very aggressive because they defend their territory and they have a penchant for fighting each other's agility with other betta fish. If they are placed in one place, then that place is often used as an arena for fighting, almost like a rooster[9]. These fish live in fresh or brackish water, the meeting of sea water and freshwater and this fish is also one of the freshwater fish which has many colors, such as red, green, blue and yellow. There are many kinds of betta fish which can be kept by betta fish lovers. There are fighting betta fish, ornamental betta fish, and wild betta fish which are usually found in rivers and swamps[10]. The types of diseases which often exist in betta fish are:

Table 1. Table of Diseases in Betta Fish

Number	Disease Code	Disease Name	Cause
1.	P01	White Spots	Virus
2.	P02	Rusty Spots (Velvet)	Virus
3.	P03	Swollen Eyes (Pop Eye)	Parasite
4.	P04	Dropsi	Parasite
5.	P05	Rot Fin	Parasite
6.	P06	columnar	Parasite
7.	P07	Fungal disease	Mushroom

Source : Tahta Istiawan Eko Nugroho (2020) [10]

As for the symptoms, it can be concluded in the following table:

Table 2. Table of Causes of Diseases in Betta Fish

Nmber	Symptom Code	Symptom Name
1.	G01	There are white spots on the body of the fish.
2.	G02	Fish lack appetite.
3.	G03	Fish do not move agile.
4.	G04	Fish fins are pointed.
5.	G05	The body of the fish is pale.
6.	G06	The fish's body is covered in shiny dust.
7.	G07	Swollen fish eyes.
8.	G08	Swollen fish belly.
9.	G09	Fish can't poop.
10.	G10	Fish fins are decayed.
11.	G11	Red or black marks appear on the fish's body.
12.	G12	There are ulcers or lesions on the body of the fish.
13.	G13	Change in gill color.
14.	G14	There are white spots in the mouth of the fish.
15.	G15	There are white lumps like cotton on the fish's body.

Table 3. The Relationship between Symptoms and Disease

Number	Symptom Password	P01	P02	P03	P04	P05	P06	P07
1.	G.1	<						
2.	G.2	<	<					
3.	G.3	<		<				
4.	G.4	<						
5.	G.5		<	<	<	<		
6.	G.6		<					
7.	G.7			<				
8.	G.8				<			
9.	G.9				<			
10.	G.10					<		<
11.	G.11					<		
12.	G.12						<	
13.	G.13						<	<
14.	G.14						<	<
15.	G.15							<

2.3. Forward Chaining

Giarratano and Riley in the said that Forward Chaining is an expert system which seeks or traces solutions through problems. In other words, this method requires a good consideration of the facts which then leads to a conclusion based on valid facts. This method is the opposite of the backward chaining method which can

perform a search which starts from the hypothesis to the facts to support the hypothesis. Forward Chaining is also called bottom-up reasoning because this method considers facts from the lowest level to the highest level based on the facts[2], [8], [11], [12].

Forward tracing is a method of reasoning. Data-driven search, the search starts from the premise or input information first then goes to the conclusion or derived information. In this method, there is data needed to set rules and some will be carried out by providing data to be evaluated in order to find a result in the problem. The inference method is influenced by 3 kinds of searches:

a. Depth-first search
b. Breadth-first search
c. Best-first search [13]–[15]

III. RESEARCH METHODS

3.1. Data collection

This study uses some of the data which has been collected covering several kinds of betta fish diseases. This information also comes from several sources, for example the internet, newspapers and the breeders themselves. The design of an expert system uses the forward chaining inference method.

3.2. System design

Systems Development Life Cycle is the process of forming and editing a system with a model which is used to develop the system. The concept of this system has a general purpose on the computer system or information. SDLC is a system pattern used to develop software. The system stages consist of a plan, analysis stage, design stage, implementation stage, system testing and management[16][17].

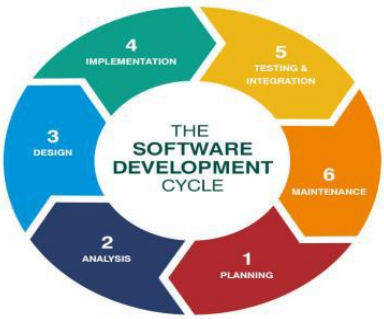

Figure 2. System Development Life Cycle

3.3. Research Analysis

1. Assessment

   The main purpose of the assessment is the process of determining the feasibility of the problem which has been in accordance with the objectives. This stage describes the feasibility of the problem, needs analysis, and sources of knowledge.

a. Eligibility Regarding Problem

   The problem of disease in betta fish is more common in ornamental betta fish. Betta fish keepers, especially novice breeders, do not know how to see betta fish which are infected with the disease or betta fish which are not infected. Some of

the diseases which attack betta fish are White Spots, Rusty Spots (Velvet), Swollen Eyes, Dropsi, Rot Fin, Columnars, and Fungal Diseases.

b. Need analysis

The design of an expert system for diagnosing diseases in betta fish requires an analysis process first in designing the system. The requirements which will be used are hardware requirements. The hardware requirements used are a processor with a dual core specification of 2.20GHz or above, 2GB RAM or above, and a free 10GB HDD.

c. Source of knowledge

The sources of knowledge in this expert system come from experts in certain fields who have experience in solving existing problems. In addition to sources from experts, sources of knowledge obtained from several other sources are such as information from books or from the internet.

2. Knowledge acquisition

Knowledge acquisition is the process of obtaining knowledge about disease problems in betta fish to be used as a guide in designing an expert system for diagnosis of diseases in betta fish. The knowledge which has been obtained is used to provide information about various types of diseases in ornamental fish and how the initial symptoms and solutions to treat the disease are. At this stage there are activities such as knowledge acquisition result and tree diagram.

a. Knowledge acquisition result

At the knowledge acquisition stage, several formula data were gathered and a knowledge acquisition table was created. The incorporation of these formulations aims to gain knowledge about diseases that infect betta fish.

b. Tree diagram

Pada tahap akuisisi pengetahuan sudah dijelaskan mengenai penyebab terjangkitnya suatu penyakit pada ikan cupang dan hasilnya akan diimplementasikan pada gambar 3 berikut ini.

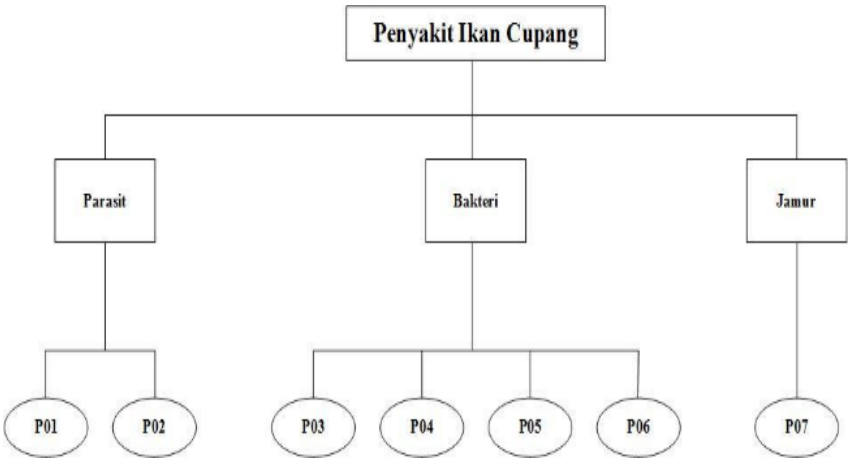

Figure 3. Tree Diagram

IV. DISCUSSION

4.1. System design

The use case diagram shows that there are two users, the user and the admin where the admin enters some of the symptoms and diseases of betta fish and then

proceeds to diagnose them. Meanwhile, the user enters several symptoms and then determines the diagnosis.

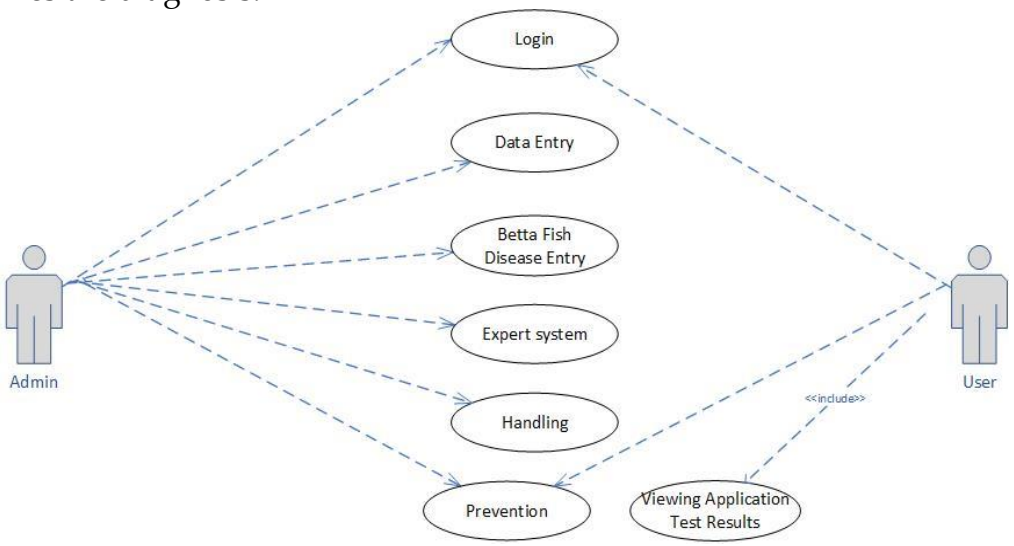

Figure 4. Use Case Diagram

This is the creation of forms from the attributes involved in the proposed system. This attribute modeling is visualized with a class diagram.

Figure 5. Class Diagram

4.2. Implementation

a. Login Menu

The main starting menu is when the user first opens the betta fish disease diagnosis system. This page is the main admin and cultivator user page which has a menu:

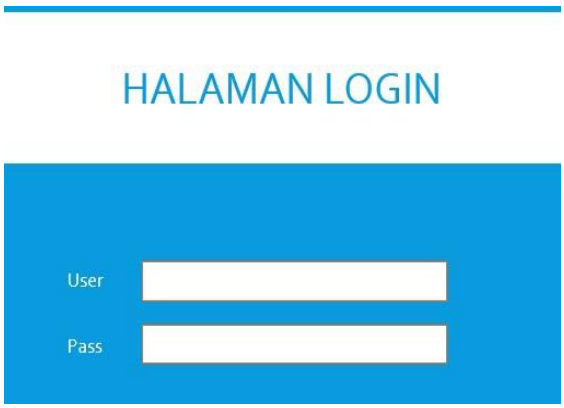

Figure 6. Homepage

b. Cultivator User Display

The view of the cultivator user displays data on visitors who keep betta fish. The menu display contains the problems experienced by the user or the user regarding his betta fish which is affected by the disease so that it needs to be consulted.

Figure 7. Cultivator User Display

d. Disease Menu Display

The display of the disease menu contains several diseases in betta fish. User data page contains data about users who have visited the expert system.

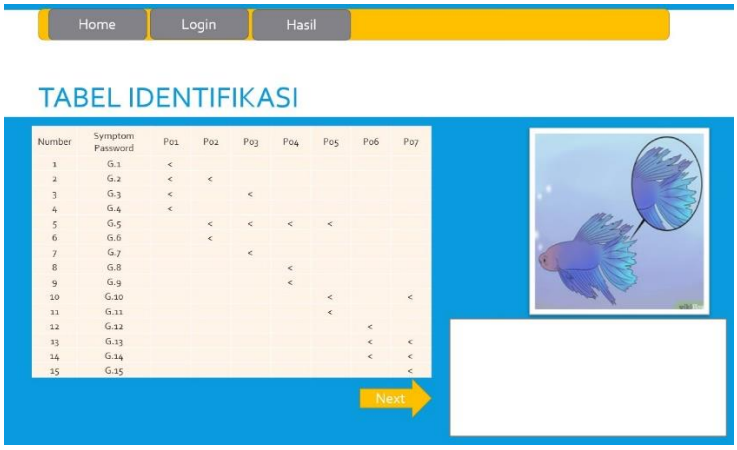

Figure 8. Display of disease menu

4.3. System Test Results Analysis

The test results are both in the website and the system. These results can be seen in the system test with a block box.

Table 4. Analysis of System Test Results

Number	Menu Test	Analysis result		Information
		Error	Running	
1.	Home page menu	-	Running	Success
2.	Main menu admin	-	Running	Success
3.	Cultivator menu	-	Running	Success
4.	Disease menu	-	Running	Success
5.	User Data Menu	-	Running	Success

The results of the system test above state that the results of the tests carried out can run so that it shows that the system created has been successful and can be used by people who cultivate betta fish without having to invite experts at an expensive cost.

V. CONCLUSION

In the description of the "Expert System for diagnosing diseases in betta fish based on android", the author can conclude that an application of an expert system for diagnosing diseases for betta fish can be useful as a disease identification tool along with symptoms and solutions which are equipped with treatment for betta fish. Users can also go deeper into every symptom of the disease in the fish and can immediately find a solution. This expert system research is good for the use of the forward chaining method. Because in using the application, the steps taken include collecting facts in advance about all the data needed for the application of an expert system for diagnosing diseases in betta fish. The facts that are in the process become a conclusion in the form of data on the name of the disease in betta fish and their symptoms and handling using reasoning techniques. With the application of this expert system, it is hoped that it can solve a problem in handling diseases in betta fish.

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