

## Determining Diseases in Goldfish Using WEB-Based *Forward Chaining Expert System Technology* in Lawe Malum Village


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### ABSTRACT

Type lots of fish cultivated by farmer fish is Goldfish caused because convenience in cultivated and marketed. Because many can utilized from Goldfish. That problem often happen is farmer goldfish are not in a way routine do maintenance cause fish caught disease. Case the caused because farmer Still lay to symptom and type disease in cultivation goldfish, so make easy goldfish attacked disease. This matter make farmer difficulty in handling to disease that arises exercise symptom Because limited knowledge. Limitations expert in field knowledge cultivation fish sir is Wrong One frequent problem found in various area. Study This aim For identification disease on goldfish use technology system Forward Chaining expert based symptoms And designing System Expert in identify disease And method treatment on goldfish. Necessary data moment study This is data type symptom And type disease based on symptom on goldfish, symptom data and treatment data take sourced decisions from expert cultivation goldfish from a school teacher Intermediate Vocational major cultivation fishery and the data obtained from Service Municipal Fisheries. Based on the data provided by expert, expert own method taking decision, that is gather facts moreover formerly For reach something conclusion or decision, so technology system expert can used For do study This. Stages processing the data like prepare data input, tables decision experts, determine rules, carry out tracking processes, create decision tree And results tracking. The results obtained succeed find disease based on existing symptoms And can found as well as solution step beginning For handling to disease goldfish. Results test try doing that with compare data with system that has designed own level very accuracy Good.

**Keyword:** Technology, Expert System, Forward Chaining Method, Goldfish Disease, Goldfish Cultivation, Identifying.

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### 1. INTRODUCTION

Southeast Aceh Regency is one of the major districts in the field of agriculture and animal husbandry, one of which is the husbandry and cultivation of goldfish (Rusdiansyah et al., 2018). Goldfish cultivation is one of the livelihoods of the people of Southeast Aceh district (Rizky et al., 2020). Goldfish is one of the fish that is often indicated because goldfish are susceptible to disease (Setiawaty et al., 2018). The problem in Southeast Aceh Regency is that it is difficult to find specialists related to goldfish handling, because Southeast Aceh Regency is a district with the smallest regional APBD income, which results in low regional allowances and few government servants who want to serve in Southeast Aceh district (Chen et al., 2021). The development of computer technology during the current industrial revolution can be seen from the large number of uses of computers aimed at making human work easier (Wahyuni et al., 2019). The use of computer tools that were originally used for calculating until now computers can be utilized so that the work of today's computers can resemble the work of the human brain (Sigit M et al., 2021). So computers can be used to detect a diagnosis in solving a problem in the same way as the human brain works (Ismah et al., 2021). Based on this explanation, it becomes the basis for implementing an expert system application in diagnosing disease in goldfish using the *Forward Chaining method* (Larasaty et al., 2024).

Goldfish are one of the livestock animals that are cultivated and then become quite a promising business for goldfish farmers. One disease that often occurs in goldfish which is very dangerous is bacteria. Bacteria can cause death in very large numbers of fish in one pond. Bacteria can also cause

infectious diseases in goldfish. If one fish is exposed to bacteria, it will spread throughout the pond (Wahyuni et al., 2019). If this condition occurs it will cause huge losses for goldfish farmers. Based on the chronology of what happened, the development of knowledge regarding problems with goldfish disease developed very quickly. With this development, it turns out that scientists are increasingly encouraged to further develop computer system technology so that it can help human work. One of the developing fields of science is technology in the agricultural sector, namely efforts to identify diseases in goldfish using computer technology.

Goldfish are the same as other freshwater fish which are often affected by diseases caused by bacteria and usually occur due to lack of care on the water that enters the pool and the cleanliness of the pool, but that does not mean that a well-maintained pool is not affected by disease (Sigit M et al., 2021). Diseases in Goldfish can have sources from outside ( *external factors* ) and from within ( *internal* ) which can affect the condition of the pool and the temperature of the water in the pool. To avoid this, it is better to take preventive measures by taking good care of the pool. To solve this problem, ask fisheries experts to provide knowledge about how to cultivate goldfish properly and correctly. Experts can also provide knowledge about the various things that can attack goldfish and how to prevent and overcome them (Ismah et al., 2021). If goldfish are infected with disease, it can cause the harvest to decrease due to the poor quality of the fish when harvested. One of the factors that causes this problem is because many farmers still don't know about the disease and how to treat it and sometimes even underestimate every symptom in goldfish. An expert system is a system that utilizes expert knowledge to make effective decisions to solve problems. Expert systems can be distinguished from other general systems based on their ability to infer based on expert knowledge (Darmansyah et al., 2021). Expert Systems are a branch of *Artificial Intelligence* that functions to assist humans in solving various problems that can only be solved by experts (Jamil et al., 2024). Expert system research also aims to help solve complex problems with human knowledge, and this system can present human intelligence in the form of machine language commands (Darmansyah et al., 2021). An expert system is a computer program where the program has knowledge like an expert or expert. Currently, there are many implementations of expert systems in various fields and scientific disciplines, of which agriculture is one of them (Jamil et al., 2024).

In designing a good expert system, the designed application must be able to solve various problems by imitating the work and thinking of experts or experts (Kartika et al., 2022). With the existence of expert system technology, society can take advantage of this technology in solving real problems using expert system technology.

The author can conclude that expert system technology is software that is created using machine language and its capabilities are made similar to those of an expert, where the expert system seeks to implement the abilities of an expert to solve a problem, in accordance with the knowledge possessed by experts in their field. The aim of an expert system is not to replace the role of humans, but to substitute human knowledge into a system form, so that it can be used by many people (Prayuda et al., 2021).

*Forward Chaining* is a forward search technique that combines rules to achieve a goal. With this technique, inference engines can divert reasoning from a problem to a solution. The process will produce a conclusion if the premise clause matches the circumstances (values TRUE) (Larasaty et al., 2024). The computer will solve the problem by finding facts that match the IF part of the IF-THEN rule.

*Forward Chaining* is reasoning that is carried out from below then upwards through reasoning from facts ( *evidence* ) from the lowest level to the top level which is based on a fact (Prayoga et al., 2021). Forward tracking is an approach that comes from data ( *data-driven* ). This forward tracking is very good in identifying diseases found in goldfish because the entire process will be carried out sequentially based on the problems above and existing *literature studies* (Fatman et al., 2021). *The Forward Chaining* method has been used in research, including an expert system that can diagnose osteoporosis in the elderly. This research uses a web-based *Forward Chaining method*. Where the data used is data on symptoms of osteoporosis experienced by the elderly based on an expert. Based on the test results, the results obtained were, from 6 activities, 5 of them obtained accurate results and 1 of them obtained inaccurate results with an accuracy percentage reaching 83.3% and an inaccurate data value of 16.7%. Based on the results, it can be concluded that research on an expert system for diagnosing osteoporosis in the elderly using the *Forward Chaining method* has functioned quite well (Fatman et al., 2021). Furthermore, research using the same method includes an expert system that can be used in psychology. This research is about how to determine a person's personality type using an expert system to provide time efficiency and reduce costs. This research uses data regarding personality traits. The method used is *Forward Chaining*. The result of this research is a web-based application that can detect a person's personality type. The conclusion of this research is that using an expert system with the *Forward Chaining method* makes it easier for users to find or analyze a person's personality type and does not need to wait a long time (Fuad et al., 2022). Based on

the various sources above, this research can provide a summary that *Forward Chaining* is a fact to get a *conclusion* or commonly known as a conclusion from this fact. This reasoning is based on existing facts (*data driven*), where this method is carried out by collecting existing facts to draw a conclusion. The process starts from existing facts through the process of reasoning the facts towards a *goal* (a goal) (Nurjumala et al., 2022). Based on previous research conducted using the *Forward Chaining method*. So The author carried out this research to identify diseases in goldfish using expert system technology with the *Forward Chaining method*. Aims to make it easier for carp farmers in Southeast Aceh district to facilitate disease management and treatment of carp.

## 2. RESEARCH METHODS

The method used is *Forward Chaining* to Determine Diseases in Goldfish Using WEB-Based Forward Chaining Expert System Technology in Lawe Village. The next method is the existing tracking technique and combining rules to produce a conclusion in the form of information. The results obtained in this research aim to educate the public to care about the health of goldfish. If disease in goldfish is left unchecked, it can result in losses for goldfish farming farmers.

### 2.1 . Expert system

An expert system is a computer program that simulates behavior man Which have knowledge and expert experience in a particular field. Usually the system contains a base knowledge, accumulated experience and a set of rules to apply the conditions of each particular situation described in a program [4].

### 2.2 . Method *Forward Chaining*

*Forward Chaining* method is a reasoning method that starts from facts to reach a conclusion from those facts. Reasoning starts from the facts first and then obtains the truth of the hypothesis (Rolos et al., 2022). *Forward Chaining* Method will work if the work begins with recording information and is expected to reach completion or the final goal. In this approach, data is used to define the rules to be enforced and then these rules are executed. This process will be repeated until results are found. *Forward Chaining* Inference is suitable for solving control and prediction problems (Kartika et al., 2022). An illustration of the *Forward Chaining* method is presented in Figure 1.

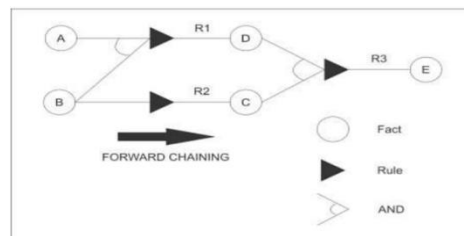


Fig 1. Illustration of the *Forward Chaining* Method

### 2.3 . Diseases in Goldfish

Diseases that often occur in goldfish consist of 3 categories, including diseases of fish gills, water fleas and diseases of fish fins. Goldfish gill disease is a disease found in the gills of goldfish and this type of fish disease is very dangerous because it can cause mass death of goldfish in one pond, fin disease in fish is caused by water fleas and sticks to the goldfish's fins and causes the fish's fins to peel off. carp and rot occurs resulting in wounds on the goldfish's fins and then the type of water flea disease in goldfish is caused by the lack of cleanliness of the pond where it is cultivated, lack of cleanliness in the pond, both from the condition of the water entering the pond and the environment around the pond which is less clean, one of which is can cause disease in fish. To anticipate fin disease in goldfish, you can replace the pond water periodically and administer bacterial medication to the goldfish pond. (Prayuda et al., 2021).

### 2.4 . Method of collecting data

The level of data collection using 3 methods, namely through supporting data from journals, books and other references, observation and interviews .

- a. Study of literature  
Data collection is by collecting literature, journals, papers and readings that will be discussed based on books related to the research title to help complete development in this system.
- b. Observation  
Techniques include conducting research and direct observation of problems taken through direct communication with carp cultivation farmers. and the HR & ADM (Human Resources & Administration) section with fisheries experts who know about carp disease data.
- c. Interview  
Techniques by holding direct questions and answers related to topics taken from the software creation stage.

## 2.5 . Framework

A research, The first step that must be taken is to form a research framework. The framework in this research includes identify problems, analyze problems, determine objective, studying literature, collecting data, analyzing data to process data , implementing system performance , results and discussion. The framework for this research can be seen in Figure 2 .



Fig 2. Research Framework

## 3. RESULTS AND DISCUSSION

Next, the author carried out activities to explore the knowledge base by grouping various symptoms and types of diseases in goldfish into a table. Next, analyze the system using several algorithms with stages, namely the *Forward Chaining Method* as follows:

- a. Specifies input data
- b. Determine the expert decision table
- c. Determining *rules*
- d. Determine the tracking process
- e. Create a decision tree
- f. Tracking results

### 3.1 . Determining Input Data

Types of diseases in goldfish processed into the system are 9 types of diseases. Every kind of disease given a code in the form of letters and numbers as shown in Table 1.

Table 1. List of Diseases

No	Disease Name	Code disease
1	Pseudomonas spp.	S01
2	Aeromonas Hydrophila	S02
3	Hexamita	S03
4	<i>Saprolegniasis</i>	S04
5	<i>White Spot Syndrome</i>	S05
6	Tuberculosis	S06
7	<i>Velvet</i>	S07
8	<i>Gyrodactylosis</i>	S08
9	<i>Columnarist</i>	S09

Goldfish symptoms listed here is 20 types of symptoms. Symptoms are given codes in the form of letters and numbers for information on each symptom which can be presented in Table 2.

Table 2. List of Symptoms

No	Symptom Names in Goldfish	Symptom Code
1	Weak	X01
2	Fin color changes to red	X02
3	Body color becomes dark	X03
4	Overproduction	X04
5	Bleeding under the skin	X05
6	Decreased appetite	X06
7	Scales peel off	X07
8	White feces	X08
9	There are fine threads like cotton on the body	X09
10	Fish become thin	X10
11	Floating on the surface of the water	X11
12	White spots on the surface of the body	X12
13	Mass Death	X13
14	Circling around	X14
15	Slow Growth	X15
16	A gold colored bitnik appeared	X16
17	The fins are closed	X17
18	The fish are slow	X18
19	Rubbing your body against the wall	X19
20	Fin Loss	X20

### 3.2 . Determine *Rule (Rules)* based on the data obtained

Based on the data presentation and process described above, to design and plan disease identification in carp , a list of rules has been prepared *in accordance* with the procedure using logical expressions as in Table 3.

Table 3. Determining *Rules (Rules)*

No	Rules for Diseases in Goldfish
1	If X1, X2, X3, X4 and X5 than S01
2	If X4, X3, X6 and X7 than S02

- 3 If X3, X6 and X8 than S03
- 4 If X3, X4, X6 and X7 than S02
- 5 If X1, X6b, X11, X12, X13 and X14 than S05
- 6 If X1, X6, X11, X12, X13 and X14 than S05
- 7 If X3, X4, X6 and X7 than S02
- 8 If X2, X3, X6 and X15 than S06
- 9 If X1, X6, X11, X12, X13 and X14 than S05
- 10 If X6, X16, X17 and X18 than S07
- 11 If X12, X9 and X21 than S09
- 12 If X9, X2, X6 and X10 than S04
- 13 If X11, X6, X12, X13 and X14 than S05
- 14 If X1, X3, X4, X5, X7, X19 and X20 than S08

### 3.3 . Carrying out the Tracking Process

Tracking in the system will be carried out using the relationship between symptoms and types of disease in goldfish by sharing a conclusion like an expert. The relationship between disease and symptoms in goldfish can be seen in Table 4.

Table 4. Relationship between disease and symptoms

No	Code g sympt oms of diseas e	Name the symptoms of disease in goldfish	Disea se code	Disease name
1	X01, X02, X03, X04, X05	Weak The color of the fins becomes red Body color becomes dark Overeating production Bleeding under the skin	S01	Pseudo monas spp.
2	X03, X06, X08,	Body color becomes dark Decreased appetite Red feces	S03	Hexami ta
3	X03, X04, X06, X07	Body color becomes dark Overeating production Decreased appetite Scales peel off	S02	Aeromo nas Hydrop hila
4	X01, X06, X11, X12, X13, X14	Weak Decreased appetite Floating on the surface of the water White spots on the surface of the skin Mass Death Round and round	S05	WSS disease (White Spot Syndro me)
5	X02, X03, X06, X15,	The color of the fins becomes red. The skin color of the body becomes dark Decreased appetite Slow growth	S06	Tuberc ulosis
6	X06, X16, X17, X18,	Decreased appetite Gold spots appear The fins are closed The fish are slow	S07	<i>Velvet</i>
7	X12, X09, X20,	White spots on the surface of the skin There are fine threads on the skin Fins fall off.	S09	<i>Column arist</i>

8	X09, X02, X06, X10	There are fine threads on the skin The color of the fins becomes red Decreased appetite Fish become thin	S04	<i>Saprolegniasis</i>
9	X01, X03, X04, X05, X07, X19, X20	Weak Body color becomes dark Overproduction Bleeding under the skin Scales peel off Rubbing your body against the wall Fins fall off	S08	<i>Gyrodactylosis</i>

Based on Table 5, it can be explained that S1 is *Pseudomonas spp disease*, S2 is *Aeromonas Hydrophila disease*, S3 is *Hexamita disease*, S4 is *Saprolegniasis disease*, S5 is *WSS (White Spot Syndrome) disease*, S6 is *Tuberculosis disease*, S7 is *Velvet disease*, S8 is *Gyrodactylosis*, S9 is *Columnaris*. The search process is carried out by connecting the relationship between disease and symptoms which will then provide a solution or treatment like an expert (expert).

### 3.4 . Search Results are determined from Decision Trees

Decisions will occur if the disease and symptoms show a relationship between objects. The data used to carry out searches is taken from several *rules*. The decision tree can be seen in Figure 3.

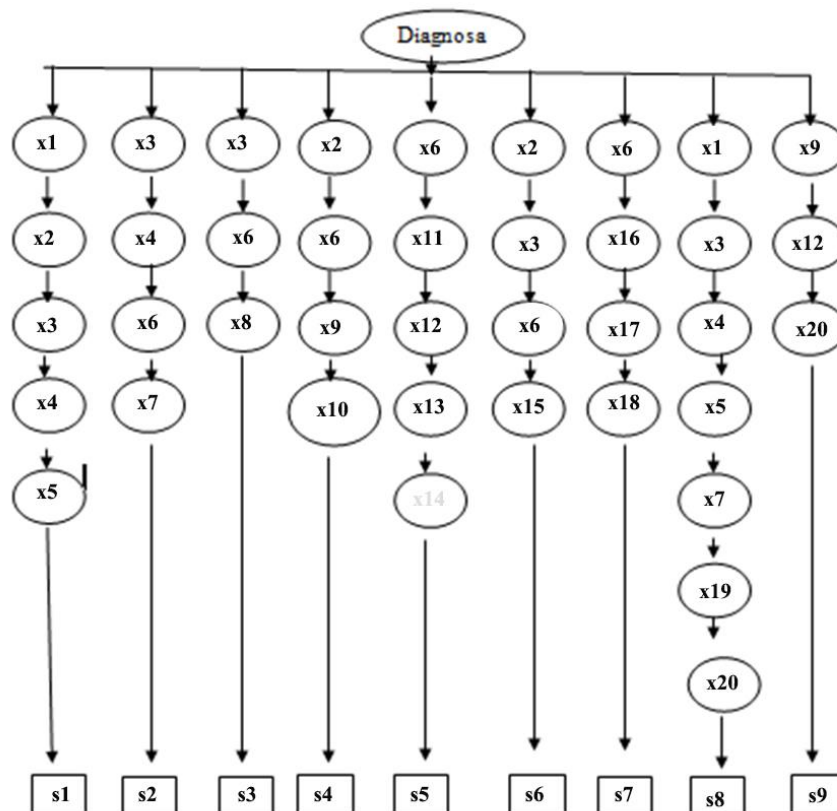


Fig 3. Decision Tree

### 3.5. Tracking Results

After the *rule* preparation process is carried out, the next table is the results table of symptoms and diseases which can be seen in Table 5.

Table 5. Tracking Results

Rules	If	Then
RL1	X1,X2, X3, X4,X5	S01
RL2	X3,X6,X8	S03
RL3	X3,X4,X6,X7	S02
RL4	X1,X6,X11,X12,X13,X14	S05
RL5	X2,X3,X6,X15	S06
RL6	X6,X16,X17,X18	S07
RL7	X12,X9,X21	S09
RL8	X9, X2,X6,X10	S04
RL9	X1,X3,X4,X5,X7, X19, X20	S08

The results of the tracking process using the *Forward Chaining method* with symptoms are Weakness (X01), Fin color becomes Red (X02), Body color becomes dark (X03), Excessive eating production (X04), Bleeding under the skin (X05), if these criteria are found then, the disease resulting from identification in goldfish is *Pseudomonas spp* (S01)

If the body color becomes dark (X03) Production of excessive eating (X04) Appetite decreases (X06) Scales peel off (X07) then, the disease resulting after identification is *Aeromonas Hydrophila* (S02).

If the symptoms are dark body color (X03), decreased appetite (X06), red stools (X08), then the disease found after identification is *Hexamita* (S03).

If there are fine threads on the skin (X09), the color of the fins becomes red (X02), the appetite decreases (X06), the fish becomes thin (X10), then the disease produced based on the identification results is *Saprolegniasis* (S04).

If you are weak (X01), decreased appetite (X06), floating on the surface of the water (X11), white spots on the surface of the skin (X12), mass death (X013), spinning around (X04), then the disease found based on the identification results is *WSS disease (White Spot Syndrome)* (S05).

If the color of the fins becomes red on the skin (X02), the body color becomes dark (X03), the appetite decreases (X06), the growth is slow (X15), then the disease resulting from the identification results is *Tuberculosis* (S06).

If the appetite decreases (X06), golden spots appear (X16), the fins flop (X17), the fish becomes slow (X18), then the disease produced based on the identification results is *velvet* (S07).

If Weak (X01), Body color darkens (X03) Excessive production (X04) Bleeding under the skin (X05) Scales peel off (X07) Body rubs against the pool wall (X19) Fins fall out (X20) then, the resulting disease is based on the identification results is *Gyrodactylosis* (S08).

If there are white spots on the surface of the skin (X12), there are fine threads on the skin (X09) the fins fall out (X20), then the disease produced based on the identification results is *Columnaris* (S09).

### 4. CONCLUSION

Expert System Technology with the Forward Chaining method can identify diseases in goldfish by processing symptoms in goldfish so that the disease and solutions and initial steps for handling can be determined. The results of the trial conducted by comparing data with the designed system have a very good level of accuracy. So that the designed system can be used to identify diseases in goldfish.



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