Lovebirds type identification designing based on color using automaton theory

by Sumarno Danang

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Abstract - *Lovebirds are a unique and legendary bird species that can attract most bird lovers in Indonesia. The colors and types are also varied, ranging from valves, non-valves, colorful feathers starting from the lungs, eyes, chest, tail wings, and so forth. In addition to a variety of colors, the birds singing is also another attraction for bird lovers. But for the general public as well as beginner Lovebirds hobbyists, it is difficult to know the type of each Lovebirds they meet or have. This is due to the lack of knowledge they have about Lovebirds, so we need a system that can help them in solving problems to find out the name of the species on a specific basis.*

Expert systems are computer programs that simulate the reasoning of an expert with expertise in a particular area of knowledge. Expert systems work based on theory, rules, and knowledge base. The theory is the necessary foundation in making an expert system as a substitute for an expert's logic mindset. Automaton theory of intelligent abstract modeling recognition machine is one theory that can work on a system to resolve uncertainty according to predetermined rules, especially reading the input of words or context-free language, and then can conclude whether the writing is following the state of the regulation set in the programming language. The results of this study resulted in an expert system application to identify Lovebirds based on the color of feathers found in the body of the lovebird using finite-state Automata.

Key Words: *Expert System, Lovebirds, Automaton Theory.*

1. INTRODUCTION

Lovebirds are one of the birds that are unique in the field of chirping and color that can captivate most bird lovers in Indonesia. For the general public as well as beginner Lovebirds hobbyists, it is difficult to know the type of each Lovebirds they encounter or have. This is due to the lack of knowledge they have about Lovebirds, so we need a system that can help them in solving problems to find out the name of the species on a limited basis. Expert systems are computer programs that mimic the reasoning of an expert with expertise in a particular area of knowledge. Expert systems work based on theory, rules, and knowledge base.

Automaton Theory is the study of abstract computing devices, or "machine recognition." The theory was initially proposed to model brain function, turned out to be very useful, and can help various other problems associated with intelligent computer systems (John E. Hopcrof, Rajeef Motwani, Jeffry D. Ulman in his book Introduction to Computer Theory). Automaton theory also can work on system logic and can be understood to resolve uncertainties according to established rules.

Lovebirds are one of the birds that are unique in the field of chirping and color that can captivate most bird lovers in Indonesia. For the general public as well as beginner Lovebirds hobbyists, it is difficult to know the type of each Lovebirds they encounter or have. This is due to the lack of knowledge they have about Lovebirds, so that it needs a system that can help them in solving problems to find out the name of the species on a limited basis.

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2. THEORY BASIS

Lovebirds [7]

Lovebirds are a bird of nine species of genus Agapornis (from the Greek "agape," which means "love" and "ornis," which means "bird"). They are small birds, ranging from 13 to 17 cm, weighing 40 to 60 grams, and are social in nature. [12] Eight of these species originated in Africa, while the "gray head love bird" species originated in Madagascar. Their name comes from the commonly observed behavior that a pair of love birds will sit close together and love each other. The nature of the love bird pair is monogamy in the wild.

Table 1. Kinds and features of Lovebirds

Names	Characteristic features
Green standard	Appearance feathers bright green, especially in the back, wings, to the chest and abdomen. While from the neck to the head is orange and red with a blackish tinge on the top. Lovebird is the presence of white eye circles or what is called glasses/valves.
Green Dakocan	Lovebirds have a color combination between clean green, yellow, and blackhead, feet slightly to blue-blue and generally beak red
Green Red Head	The appearance is predominantly bright green feathers, redhead, yellow neck
Green Head Black Pastel Eyes	Lovebird has a color combination of yellow and green dirty / faded, there is a sharp orange head and some people are less sharp, feet slightly blue-blue and generally the beak is red
Green Pastel Red Eyes	Just like Lovebird Pastel Green Black Eyes, this lovebird has a color combination of yellow and dirty green/faded, there is a sharp orange head and some people are less sharp, feet slightly to blue-blue and generally, The beak is red. The difference in his eyes are red
Darkgreen	he dominant coat color is dark green. The beak is red, the eyes are black, the head is reddish black, the neck is yellow and most are orange. The wings are dark green, the tail is brownish-green
Olive/Double Darkgreen/DDG	The dominant coat color is dark green. Red beak, black eyes, reddish black head, yellow neck. Brownish wing and tail
Yellow Pastel	Lovebird has a faded yellow color, the head is slightly orange, the feet are somewhat blue-blue, and the beak is generally red
Lutino Red Eyes	The bill is dark red, dominant feathers bright yellow with red eyes
Lutino Black Eyes	The beak is dark red; the dominant feathers are bright yellow with black eyes.
Blue Mangsi	Lovebird blue color is dominated by light blue and dark blue, with a white neck.
Cobalt	Lovebirds cobalt dominated by turquoise, with a blackhead, with black eyes, white valves
Blue Pastel	The head is gray, neck is white Chest and back are bluish, the lower part of the body is blue. Lovebirds are similar to White Pastels but there are still differences due to the content of eumelanin in the chest hair, wings and back. Blue Pastels inherit autosomal recessive and can be combined with one or two dark factors. If Blue Pastel is mated with Cobalt Blue which has one dark

	factor so that two dark factors are created, then a bird with mauve color will be born.
Black Head Blue Pastel	lovebird has a color combination of clean blue, white, and blackhead, slightly to blue-blue feet and generally its beak is white
Violet	Masked head, Beak light orange to the old, dark blue purplish body, black strait.
Albino Black Eyes	Lovebird has the color of pure white fur all over his body. The characteristic is that the entire body is pure white, the feet are also slightly white and the eyes are black
Albino Red Eyes	Lovebird has a clean white coat color all over its body. Its characteristic is that the entire body is pure white, its feet are also slightly white, and its eyes are red
Batman	Characteristic of the blackhead and brownish-white neck, brownish-black wings
Mocca	Lovebirds type of Mocca is dominated by brown mocca in combination with white.

Sumber. Didit, 2016

Previous research by Tedy Gumilang Sejati[1], Achmad Rizal[2], Alfian Akbar Gozali[3], with the title "Lovebirds Sound Classification with Fuzzy Logic Algorithm" is a classification study of Lovebirds based on sounds divided into three classes. The method used is the Fuzzy Logic method. Current research is the design of color-based Lovebirds species identification using Automaton theory. This first and second study both examined Lovebirds, but what distinguishes it from the current research is both the aspects studied and the methods used in their solution.

Expert system

In general, the Expert System (expert system) is one of the fields of computer science that utilizes computers so that they can behave intelligently like humans. This system seeks to adopt human knowledge into computers so that computers can solve problems as can be done by experts. Expert Systems, made in order to solve problems that are complicated enough that actually can only be solved with the help of experts. For experts

Automaton Theory

An automata engine is an abstract machine or a word or language recognition engine where receiving input is processed to produce output "(accepted or rejected)", the concept of automata is described as a working protocol application machine "(known or unknown)", for example the relationship between stores, customers and banks by analogy with a graph protocol, as payment, a customer gives a credit card to the store service, when the purchase process is done, the store service instructs the system to transfer the balance from the account customers to the store account in accordance with the price of goods purchased, then the bank transfers from the customer's account to the store account and so on. (*John E. Hopcrof, Rajeef Motwani, Jeffry D. Ulman*, 2001: 39), as well as other examples, and automata machine as a transducer that converts input sequences into output sequences, in this case seeing machines as identifiers that classify an input string into two states, both accepted and rejected. A set consisting of all lines received by the machine is said to be recognized by the machine. (*switching and automata* theory, 2010: 570-573)
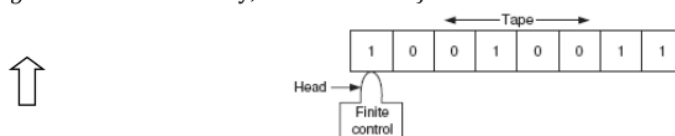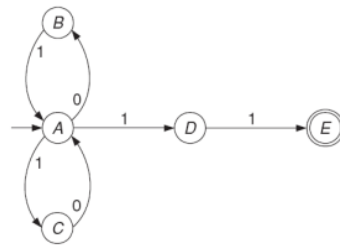
Figure 1a. How do machines read strings?

Figure 1b. State Automata

Machine: { Q(A, B, C, D, E),õ, ∑(0,1),S(A),(F)}
Dimana Q: himpunan state
        ∑ : input Alphabet
        Õ : transition fanctions Q X ∑ → Q
        S : initial State
        F : final State

The automata machine in the picture. 1b Can be explained by a state diagram where the initial status is marked with a short entry arrow and the recipient's status is marked with a double circle. For example, the state diagram describes a machine that accepts a string if and only if the string starts 01.10 and even the set is empty and ends with alphabet 11, the machine consists of three states, where A is the initial state and E is the state receiver. Note that in general, the initial state in state A and must end in state E, if we want the word or string to be accepted or known. In such cases, the machine is said to accept or recognize after reading the state of the input word/string. This machine accepts the words if and only if the input string reads the alphabetical sequence in sequence from the initial state (S) to stop at the receiving state (F)

Rules or grammar rules

        Rules or grammar rules in Figure 1b. we define grammar as follows,
        A → 1C | 0B | 1D
         B → 1A,
         C → 0A,
         D → 1E
         E → ε

Programming Theory

        Web programming consists of two syllables namely programming and the web. Programming is the process, or way, of making. Many people know the web with the term WWW (world wide web), WWW are web pages that can be connected to one another. Web pages are pure text files that contain HTML syntax that can be opened, translated with an Internet browser (Raharjo, 2011).
        HTML is a script where we can display information and our creative power through the internet. HTLM is a flexible programming language. The browser will not display a 'syntax error' dialog box if there is incorrect writing of code in the HTML script as long as the code we write is HTML code without the addition of external codes such as Java. PHP is a collection of scripts that are used to process form data from the web.

There are several ways to write script PHP, are
    1.   <?php
            Script PHP
    ?>
    2.   <?
            Script PHP
    ?>
    3.   <script language = "php">
            Script PHP
    ?>

4.   <%
   Script PHP
%>

MySQL is a database management system. MySQL is open-source software. MySQL 8 ySQL is often used in creating websites, namely: Create, Use, Show, Drop, Alter, Select, Insert, Update, Delete. XAMPP is an Apache webserver software that is embedded in a MySQL server that is supported by the PHP programming language to create dynamic websites. XAMPP itself supports two operating systems namely Windows and Linux.

The Design System

The design of knowledge-based information systems. The lovebird species identification system consists of two kinds of sources of knowledge, the first from facts, the second of the rules. Knowledge facts are facts sourced from bird enthusiasts, expert knowledge is bird species data stored in a database (table 2,3, and 4 and table), and the rule is a logical concept that can be written with a computer programming language and the results are used to link the characteristics/symptoms and facts.

Table 2. Lovebird species

Kode	Nama Jenis Lovebirds
JL-01	Green Standard
JL-02	Green Dakocan
JL-03	Green Red Head
JL-04	Black Eye Green Pastel
JL-05	Green Eyes Red Pastels
JL-06	Darkgreen
JL-07	Olive
JL-08	Yellow Pastel
JL-09	Lutino Red Eyes
JL-10	Lutino Black Eyes
JL-11	Ink
JL-12	Ink Cobalt
JL-13	Blue Pastel
JL-14	Black Head Blue Pastel
JL-15	Violet
JL-16	Albino Black Eyes
JL-17	Albino Red Eyes
JL-18	Batman
JL-19	Mocca

Color information knowledge of lovebird consisting of birds

Table 3. Knowledge Base Identification

Code	Fur color						
	Lungs	Eyes	Head	Neck	Chest	Wings	Tails
Jl-01	Read	Black	orange	orange	Yellow	Dark green	Dark green
Jl-02	Read	Black	Black	orange	Dark green	Dark green	Dark green
Jl-03	Read	Black	Read	Yellow	Dark green	Dark green	Dark green
Jl-04	Read	Black	orange	orange	Dark green	green white strait	Dark green
Jl-05	Read	Read	orange	orange	Dark green	green white strait	Dark green
Jl-06	Read	Black	Reddish black	orange	Dark green	Dark green	brownish green

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Jl-07	Read	Black	Reddish black	orange	Dark green	Brownish green	yellow, red strait
Jl-08	Read	Black	light orange	orange	Yellow	Yellow	Yellow
Jl-09	Read	Read	Read	orange	Yellow	Yellow	yellow red strait

Table 4. Knowledge Base Identification

Code	Fur color						
	Lungs	Eyes	Head	Neck	Chest	Wings	Tails
JL-10	Dark red	Black	red	orange	yellow	yellow	yellow red strait
JL-11	Ligh red	Black	Grey	White	Ligh blue	Darkblue	Darkblue
JL-12	Ligh red	Black	Grey	White	Ligh blue	greenish blue	greenish blue
JL-13	Ligh red	Black	Grey	White	Light blue	Light blue	Light blue
JL-14	Ligh red	Black	Black	White	Light blue	Light blue	Light blue
JL-15	Ligh red	Black	Grey	White	Purple	purple black strait	Purple
JL-16	Ligh red	Black	White	White	white	white	White
JL-17	Ligh red	Red	White	White	white	white	white
JL-18	Ligh red	Black	Black	White	Black	Black	Black
JL-19	Ligh red	Black	Grey	white	white	Bluish white	Bluish white

Finite State Automata

Finite State Automata is an abstract engine that recognizes or recognizes language, where the engine reads word input (word/string), and produces output of two statements namely "known or unknown" (accepted or rejected), while the concept The automata engine for the lovebird bird recognition system can be described as follows, which consists of eight States, Lung states, Eyes states, Head states, Neck states, Chest states, Wing states, Tail states, and final states, while the color is the alphabet input.
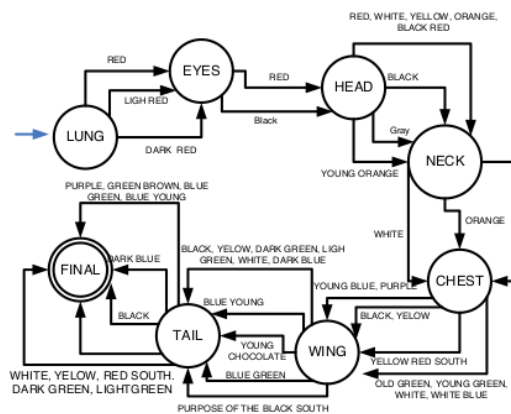
Machine:{Q(S,P,M,L,D,SY,E),õ, (Color),S,(E)}
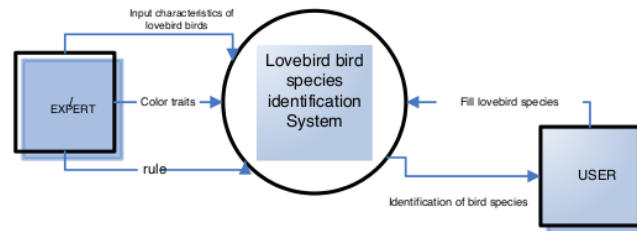

Figure 2. Lovebirds State Diagram

Figure 3. Context diagram

Flowchart

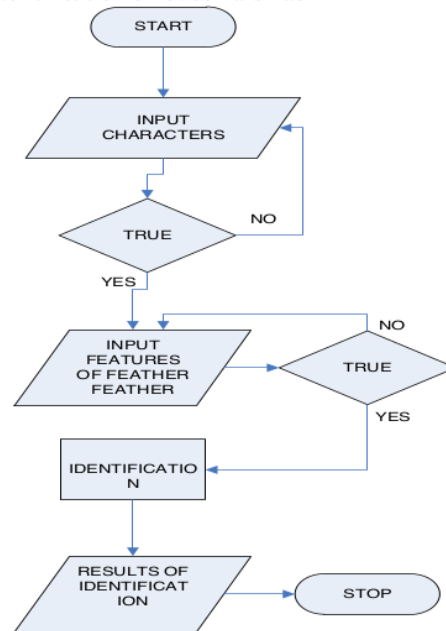Flowchart system application identification of lovebird birds.

Figure 4. Flowchart system application identification of lovebird birds.

Research result

This consultation page is a page that is used in running computer-based system applications to obtain information on the intended bird species, so that users get answers from the system, a variety of which can be seen in Figure 5 and the results seen in Figure 6. as the first search page on the user

Figure 5. Bird species search.

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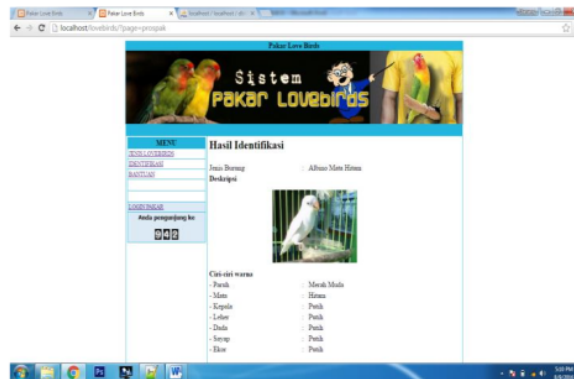
Figure 6. Type identification

Discussion of Application Programs

The computer-based Expert System application program "*IDENTIFICATION OF TYPE OF LOVEBIRDS BASED ON COLOR USING AUTOMATON THEORY*" runs using word recognition machine rules, reading then we define using a knowledge base. This method is applied to the identification process. A user who identifies Lovebirds by entering data in the form of color features in the seven columns on the form identification page (figure 6). After all the columns have been filled according to the color characteristics of the object, the user presses the identification button to start the export process.

In (figure 2), an automaton machine as a basis for the identification of Lovebirds birds. then translated with the PHP programming language script as follows.

Script php

```php
<?
include ('koneksi.php');
$tparuh = $_POST['paruh'];
$tmata = $_POST['mata'];
$tkepala = $_POST['kepala'];
$tleher = $_POST['leher'];
$tdada = $_POST['dada'];
$tsayap = $_POST['sayap'];
$tekor = $_POST['ekor'];
//kosongkan Table temp_proses
$sqldel = "DELETE * FROM temp_proses";
$prosesdel = mysql_query($sqldel);
//proses
$resulp = mysql_query("select 1 from rule where paruh like '%$tparuh%'");
if(mysql_num_rows($resulp) >0){
while($lp = mysql_fetch_array($resulp)){
$sql1 = mysql_query("insert into temp_proses (nama,paruh,mata,kepala,leher,dada,sayap,ekor)
values('$lp[nama]','$lp[paruh]','$lp[mata]','$lp[kepala]','$lp[leher]','$lp[dada]','$lp[sayap]','$lp[ekor]')");
} }
$resulm = mysql_query("select 1 from temp_proses where mata like '%$tmata%'");
if(mysql_num_rows($resulm) >0){
while($lm = mysql_fetch_array($resulm)){
$sql2 = mysql_query("delete from temp_proses where mata not like '%$tmata%'");
}}
$resulk = mysql_query("select 1 from temp_proses where kepala like '%$tkepala%'");
if(mysql_num_rows($resulk) >0){
while($lk = mysql_fetch_array($resulk)){
```

```php
$sql3 = mysql_query("delete from temp_proses where kepala not like '%$tkepala%'");
}}
$resull = mysql_query("select 1 from temp_proses where leher like '%$tleher%'");
if(mysql_num_rows($resull) >0){
while($ll = mysql_fetch_array($resull)){
$sql4 = mysql_query("delete from temp_proses where leher not like '%$tleher%'");
}}
$resuld = mysql_query("select 1 from temp_proses where dada like '%$tdada%'");
if(mysql_num_rows($resuld) >0){
while($ld = mysql_fetch_array($resuld)){
$sql5 = mysql_query("delete from temp_proses where dada not like '%$tdada%'");
}}
$resuls = mysql_query("select 1 from temp_proses where sayap like '%$tsayap%'");
if(mysql_num_rows($resuls) >0){
while($ls = mysql_fetch_array($resuls)){
$sql6 = mysql_query("delete from temp_proses where sayap not like '%$tsayap%'");
}}
$resule = mysql_query("select 1 from temp_proses where ekor like '%$tekor%'");
if(mysql_num_rows($resule) >0){
while($le = mysql_fetch_array($resule)){
$sql6 = mysql_query("delete from temp_proses where ekor not like '%$tekor%'");
//tampilkan hasil
?>
<table border="0">
<tr><td colspan="3"><h2>Hasil Identifikasi </h2></td></tr>
<tr><td>Jenis Burung</td><td>:</td><td><?php echo $le['nama'];?></td></tr>
<tr><td><b>Deskripsi</b></td></tr>
<tr><td colspan="5" align="center" ><?php
$foto = mysql_query("select * from jenis where nama like '%$le[nama]%'");?>
<?php
while($data = mysql_fetch_array($foto)){?>
<img src="pakar/gambar/<?php echo $data['foto']; ?>" style="width: 200px; height: auto; border='1';
align:center; margin: 10px 150px 10px 150px; display: inline; float: left">
<?php }?>
</td></tr>
<tr><td><b>Ciri-ci warna</b></td></tr>
<tr><td>- Paruh</td><td>:</td><td><?php echo $le['paruh'];?></td></tr>
<tr><td>- Mata</td><td>:</td><td><?php echo $le['mata'];?></td></tr>
<tr><td>- Kepala</td><td>:</td><td><?php echo $le['kepala'];?></td></tr>
<tr><td>- Leher</td><td>:</td><td><?php echo $le['leher'];?></td></tr>
<tr><td>- Dada</td><td>:</td><td><?php echo $le['dada'];?></td></tr>
<tr><td>- Sayap</td><td>:</td><td><?php echo $le['sayap'];?></td></tr>
<tr><td>- Ekor</td><td>:</td><td><?php echo $le['ekor'];?></td></tr>
</table>
<?php
}}
else{
echo 'Jenis burung Lovebirds tidak Terdaftar!';
}
?>
```

Application Testing

When the Automaton Machine reads the word (Lovebird lungs are red, eyes are black, head is orange, neck is yellow, chest is dark green, wings are dark green, tail is dark green) and then Machine percept and producing green lovebird standard species, can be seen Computer program application in Figure 5,6,and Automaton machine concept and rule in figure 7, search logic in Figure 8
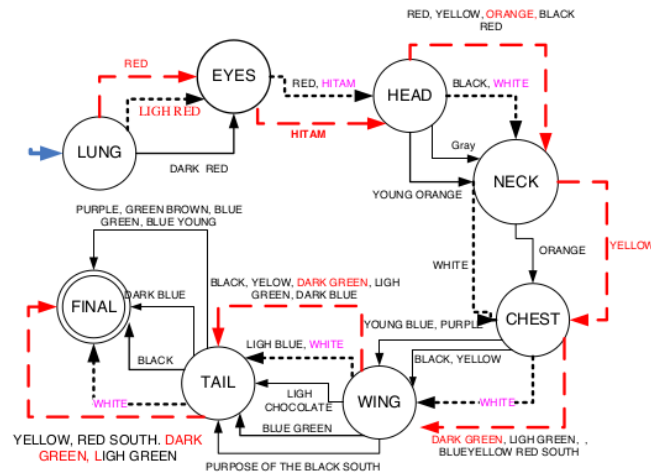The Automaton Machine Read are:

Figure 7. Transition diagram Machine to define Green Lovebirds standard and Lovebirds Albino Lovebirds Black Eyes

If translated in the machine recognizing words that are generated from the input are:
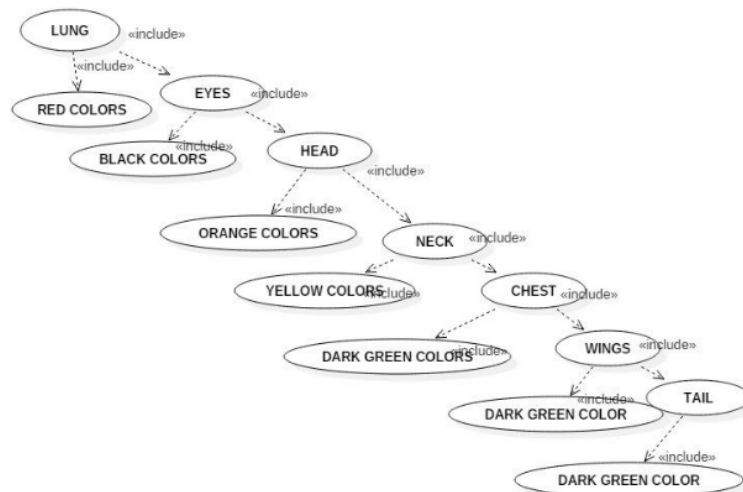
Figure 8. Decision tree kind of green Lovebirds standard

In developing this expert system, an expert can add logical rules to the knowledge base into the system's input process output (HIPO) hierarchy (figure 9)

Figure 9. Expert menu (additional types)

In table 5. It is the result of trials of nineteen kinds of Lovebird (table 2), and the results reached 100% correctness.

Table 5. Test results

NO	Fur color							MANUAL	SISTEM
	Lung	Eyes	Head	Neck	Chest	Wings	Tail		
1	RED	BLACK	ORANGE	YELOW	DARK GREEN	DARK GREEN	DARK GREEN	GREEN STANDARD	GREEN STANDARD
2	RED	BLACK	Black	ORANGE	DARK GREEN	DARK GREEN	DARK GREEN	DAKOCAN GREEN	DAKOCAN GREEN
3	LIGH RED	BLACK	WHITE	LIGHT BLUE	LIGHT BLUE	LIGHT BLUE	PURPLE BLUE	ALBINO BLACK EYES	ALBINO BLACK EYES
4	LIGH RED	BLACK	WHITE	WHITE	WHITE	WHITE	WHITE	ALBINO BLACK EYES	ALBINO BLACK EYES
5	LIGH RED	RED	WHITE	WHITE	WHITE	WHITE	WHITE	ALBINO RED EYES	ALBINO RED EYES
6	RED	RED	BLACK	ORANGE	DARK GREEN	DARK GREEN	DARK GREEN	NO LOVEBIRD	NO LOVEBIRD
7	RED	BLACK	ORANGE	YELLOW	DARK GREEN	DARK GREEN	LIGHT GREEN	NO LOVEBIRD	NO LOVEBIRD
8	LIGH RED	BLACK	WHITE	WHITE	WHITE	LIGHT BLUE	LIGHT BLUE	NO LOVEBIRD	NO LOVEBIRD
9	RED	YELLOW	BLACK BRIGHT NESS	ORANGE	DARK GREEN	DARK GREEN	BROWN ISH GREEN	NO LOVEBIRD	NO LOVEBIRD
10	LIGHT BLUE	ORANGE	DARK GREEN	DARK GREEN	RED	RED	RED	NO LOVEBIRD	NO LOVEBIRD

3. CONCLUSION

Based on the results of the study it can be concluded as follows:

1. The application of Lovebird species identification by color can help the Lovebird loving community.
2. The color features of this application are still nineteen lovebird species that can be easily recognized.
3. If there is a new Lovebird type, the system provides facilities to include bird type rules and feather color characteristics.

This application still has many shortcomings, especially in the knowledge of the introduction of lovebird species.

REFERENCES

[1] Daniel I. A. Cohen , 1986, Introduction To Computer Theory,John Wiley & Sons, Inc., Nee York

[2] John E. Hopcrof, Rajeef, Jefrey D. Ulman, 2001, Introduction to Automata to Automata Theory, Language, and Computation

[3] Soewadji, Jusuf, 2012, Pengantar Metodologi Penelitian,Mitra Wacana Media, Jakarta

[4] Kusrini, 2006, Sistem Pakar, Teori dan Aplikasi. Andi, Yogyakarta

[5] Janner Simarmata, Iman Paryudi, 2006, Basis Data, Andi, Yogyakarta

[6] Kusumadewi, Sri, 2003, Artificial Intelligence (Teknik dan Aplikasinya), Graha Ilmu, Yogyakarta

[7] Nugroho, Bunafit, 2014, AplikasiSistemPakardengan PHP dan Editor Dreamweaver, Gava Media, Yogyakarta

[8] Hakim, Lukmanul, 2014, Rahasia Inti Master PHP dan MySQLi (improved), Lokomedia, Yokyakarta

[9] Yakub, Suardi, 2008, Sistem Basis Data Tutorial Konseptual, GrahaIlmu,Yogyakarta

[10] Raharjo, Budi, 2011, Modul Pemrograman WEB, HTML, PHP, dan MYSQL. Modula,Bandung

[11] Pohan dan Bahri, 1997, Analisa dan Desain Sistem Rancangan, Andi,Yogyakarta

[12] Kadir, Abdul, 2003, Pemrograman Web Mencakup HTML, CSS, Javascript dan PHP, Andi, Yogyakarta

[13] Zvi Kohavi, 2010 Switching and Finite Automata Theory.Technion–Israel Institute of Technology Niraj K. Jha Princeton University

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