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An Expert System for Web Mobile-Based Identification of Crystal Guava Quality with Forward Chaining

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***Abstract**: An expert system is a system that applies human knowledge to a computer, the system is designed using a particular programming language so that the computer can solve problems like an expert. Currently, an expert system is being developed in various fields, one of which is agriculture. An agricultural expert system is being developed to detect various qualities using various methods, one of which is the forward chaining inference method. The forward link inference method is a forward tracking inference method, the design is simple and conforms to the existing rules. In this journal, researchers aim to design an expert system that can use forward chaining to determine the quality of mobile web-based guava seeds. The use of web-based mobile media makes access to the expert system easy and flexible because it can be accessed from mobile internet devices anytime and anywhere via a web browser. This design is used to design or build an expert system that uses the design of context diagrams and level 0 diagrams to facilitate the process of designing an expert system to identify the quality of web mobile-based guava seeds with forward chaining.*

***Keywords**: Expert System, Forward Chaiining, Web Mobile, DFD*

1. INTRODUCTION

1.1 Background

The development of technology today is very rapid and technology is a human need today. Along with the progress of industrial growth and the world economy, one branch of computer science that can help humans is an expert system. The practical purpose of this expert system is to make computers more useful to humans. Expert systems can assist humans in making decisions, seeking more accurate information or solutions. The expert system can also be applied in the field of guava plantations (*Psidium Guajava L.*) which is a plant that is widely found and in demand by the people of Indonesia. According to Damayanti (2016), guava has

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many varieties including Bangkok guava, pearl guava, breadfruit guava, red brittle guava, crystal guava, and so on. The size, color, shape, and taste of guava vary depending on the variety. One of the guava varieties that are widely found and favored by the Indonesian people today is crystal guava. According to Rosita (2019), crystal guava has spread in various regions of Indonesia such as West Java, Central Java, Yogyakarta, Lampung, West Kalimantan, South Sulawesi, Bengkulu, and NTB.
Crystal guava plants can grow well in areas with rainfall intensity between 2,000-3,000mm/year with almost uniform distribution throughout the year. Crystal guava can develop and bear fruit optimally at temperatures around 200-300C during the day, lack of sunlight causes a decrease in yield with an air humidity of 30-50% (Kurniawan, 2015). Crystal guava can grow optimally in tropical and subtropical areas with an altitude of 5-1200 meters above sea level, with loose and fertile textured soil types that can grow on clay and slightly sandy (Putri, 2019).**[6]**

The author has the initiative to research the quality of crystal guava seeds, where farmers in this crystal guava plantation have minimal knowledge about the quality of crystal guava seeds. To deal with this, we need a system that can assist farmers in understanding the quality of seeds in crystal guava, namely by developing an expert system on determining the superior quality of crystal guava. In general, an expert system is a system that seeks to adopt human knowledge to a computer that is designed to model problem-solving abilities like an expert. With this expert system, crystal guava farmers can solve their problems or just look for quality information that can only be obtained with the help of experts in their fields.

One of the implementations applied by an expert system in agriculture is for an expert system with the application of forward chaining to identify the quality of crystal guava seeds. The quality of crystal guava seeds is something that needs to be considered one by one the stages of seed development. Therefore, an expert system was built that can help experts/farmers to determine the type of superior crystal guava seeds.

Based on the description above, the writer wants to write the software design in a journal with the title "Expert System for Identification of Quality of Crystal Guava Seeds on Mobile Web-Based With Forward Chaining". The results of the decisions obtained from this study are a knowledge of the quality results of crystal guava seeds based on the existing characteristics.

1.2 Formulation of the Problem

Based on the description above, the question posed in this study is how to choose quality guava seeds so that their growth is fast and good.

1.3 Objectives of the Research and Benefits

This study aims to determine the quality level of good crystal guava seeds so that the superiority of the crystal guava seeds will be tested. By using the forward chaining method to determine quality seeds and can produce data for sure later so as to get superior crystal guava seeds.

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2. Literature Review

2.1 Theories related to the object of research

Agriculture is an activity that uses biological resources produced by humans. Production of food, industrial raw materials, or energy and management of the environment in which they live is an activity. Agriculture is divided into two broad categories, namely agriculture, and obtaining products from plants or animals is a human activity (Aarsten, 1953, "Analysis", 2015). According to Conway (1981), whether an agricultural ecosystem is one with parenting, it is managed directly by the community for the benefit of producing food, fiber, and various agricultural products. Agricultural ecosystem It is part of human ecology. *Ethnoecology* is the science of discussing humans, living space, and all activities on earth (Hilmanto, 2009)**[9]**

According to Annisa Fadhilah's research in the journal A. Fadhilah, S. Susanti, and T. Gultom, "Characterization of Guava Plants (*Psidium guajava* L.) in Namoriam Pancur Batu Village, Deli Serdang Regency, North Sumatra," Pros. Semin. Nas. Biol. and Learning, p. 1670, 2018. This type of research is descriptive by obtaining data by looking at the types of guava plants and their types of fruit. This type of research is produced from direct observation to the object to find out the type of guava l. **[5]**

2.2 The Theory About the System Used

2.2.1 Web and Mobile Web

The web is a collection of system pages that display a text, video image that uses a domain that contains various information so that it can be read by others. **[8]**

2.2.2 MYSQL

According to Anhar (2010: 21) MySQL is a database which can store data in the form of text and images for a long time**". [3]**

2.2.3 Database

Sutabri (2016) Database is a collection of interconnected data to store data from the website application system and android application. **[2]**

2.2.4 PHP

A program specially designed to create a website using C++ and Java. The php language is said to be a language translator for a program to declare a text to create a web-based program. [**4]**

2.2.5 Adobe Dreamweaver

According to the magazine Rozaq, Lestari, and Handayani (2015), Adobe Dreamweaver is: "a visual design application editor and standard functional code editor, such as syntax highlighting, code completion, and code breakdown.**[1]**

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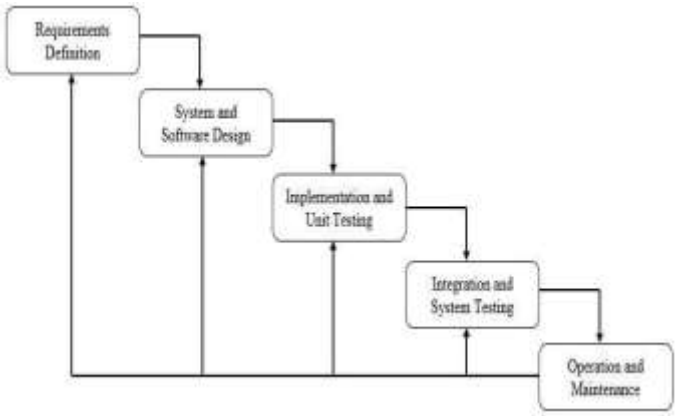
3. RESEARCH METHODS

3.1 Data collection

Data collection can be done by observing the object to be studied so that data can be collected. Data in the form of text or images that we get from an observation of the location of the object of research**. [10]**

3.2 Design Model

The waterfall method is a systematic and sequential information system development model. The waterfall method is divided into the following stages:



Picture 1.1 Waterfall

a) Analysis and definition of the main requirements must first analyze what system you want to design.
b) System and software design, this stage designs a system design to support the system that we will build later.
c) Implementation and unit testing is after the system is finished, then we will test the system, whether it is feasible to use or not.
d) System integration and testing
   The test is carried out using several smartphones so that we know the weaknesses of the system.
e) Operation and maintenance
   This stage must always optimize the system. **[7]**

3.3 Data analysis

The qualitative descriptive method is to carefully record any symptoms (phenomena) seen and heard as well as reading (Astuti, 2016). The qualitative descriptive method used in the preparation of this journal describes the selection of the quality of crystal guava seeds using the forward chaining method. Qualitative data were obtained through direct interviews with the owner of the crystal guava garden. The method used to select the quality of crystal guava seeds is a cause and effect diagram. Cause and effect diagrams are used to identify seed

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selection problems to determine the cause of damage to crystal guava seedlings so that a more in-depth analysis of the factors can be used**. [11]**

Table of 1.1 Characteristics Code

No	Characteristics code	Name characteristics
1	G004	seeds protected from disease
2	G003	seeds come from grafts or cuttings
3	G002	Seeds are taken from superior trees
4	G001	bright green leaves
5	G005	there is a connection mark on the stem
6	G006	very many fibrous roots

Table of 1.2 criteria and categories

Code	Criteria	Category
P001	- Age 54 – 61 Days - Shoot Diameter 3 mm – 6 mm	Not Good Enough
P002	- Age 54 – 61 Days - Shoot Diameter 7 mm – 8 mm	Not Good Enough
P003	- Age 56 – 62 Days - Shoot Diameter 9 mm – 10 mm	Good
P004	- Age 53 – 63 Days - Shoot Diameter 8 mm – 11 mm	Good
P005	- Age 59 – 71 Days - Shoot Diameter 6 mm – 8 mm	Not Good Enough
P006	- Age 71 – 85 Days	Not Good Enough
P007	- Shoot Diameter 8 mm – 9 mm	Good
P008	- Age 51 – 70 Days - Shoot Diameter7 mm – 8 mm	Good
P009	- Age 67 – 80 Days - Shoot Diameter 12 mm – 14 mm	Good

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P010	- Age 86 – 93 Days - Shoot Diameter 7 mm – 6 mm	Not Good Enough
P011	- Age 78 – 96 Days - Shoot Diameter 6 mm – 9 mm	Not Good Enough
P012	- Age 86 – 91 Days - Shoot Diameter 7 mm – 10 mm	Good
P013	- Age/Age 86 – 95 Days - Bud Diameter 11 mm – 13 mm	Good
P014	- Age/Age 81 – 108 Days - Shoot Diameter 7 mm – 9 mm	Not Good Enough
P015	- Age 81 – 109 Days - Shoot Diameter 8 mm – 9 mm	Not Good Enough
P016	- Age 81 – 108 Days - Shoot Diameter 9 mm – 10 mm	Good
P017	- Age 92 – 108 Days - Shoot Diameter 12 mm – 17 mm	Good

4. DISCUSSION

The expert system used to identify the quality of crystal guava seeds uses a mobile web-based forward chaining method. The expert system application that is used to determine the quality of crystal guava seeds starts from system design and is implemented using the PHP MySQL database. Process design is the design stage of the process that will run the system so that it can obtain input and output information from the system in the form of information.

1. The data flow diagram is a data flow design that occurs in processes designed in an Expert System

   If the farmer logs in by entering the correct username and password, then it is successful and the data appears.

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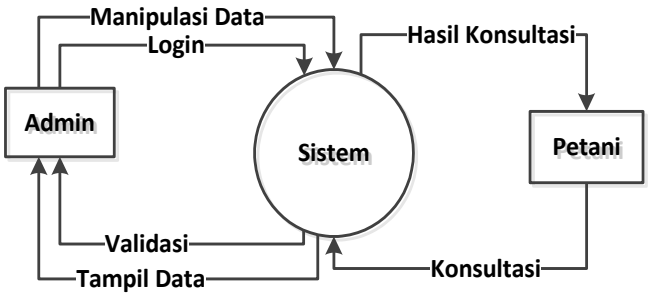
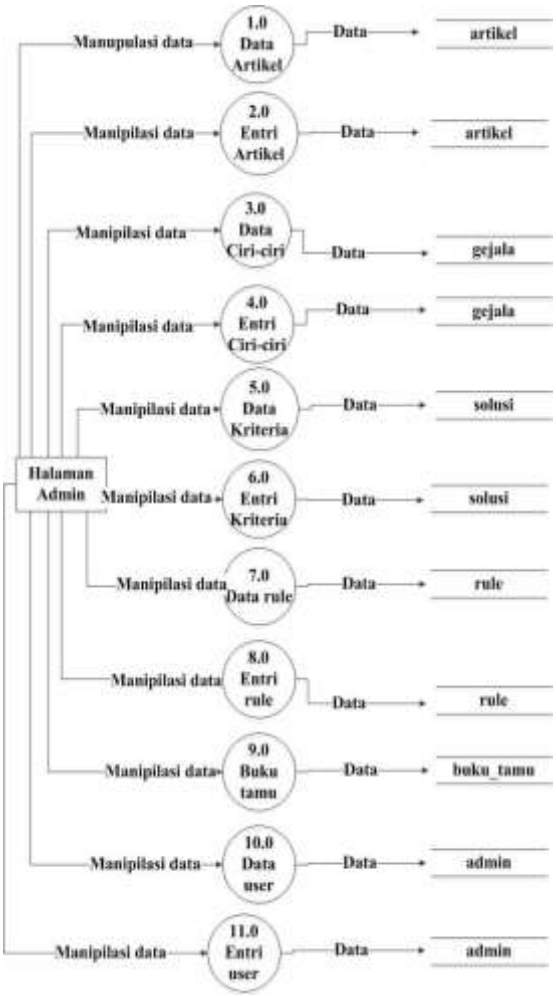


Picture 1.2 Context Diagram

2. DFD Level 0
   The function of the Level 0 DFD below is as follows:



Picture 1.3 DFD Level 0

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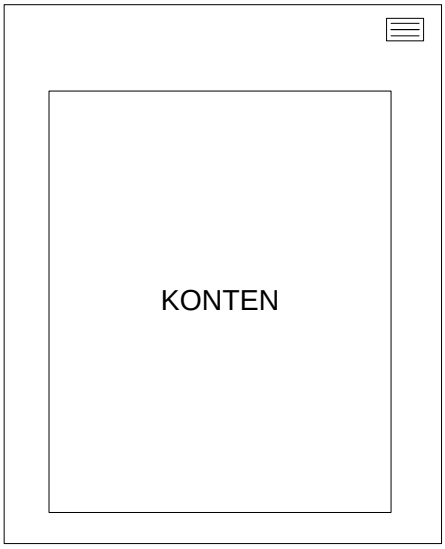
4.1 Design

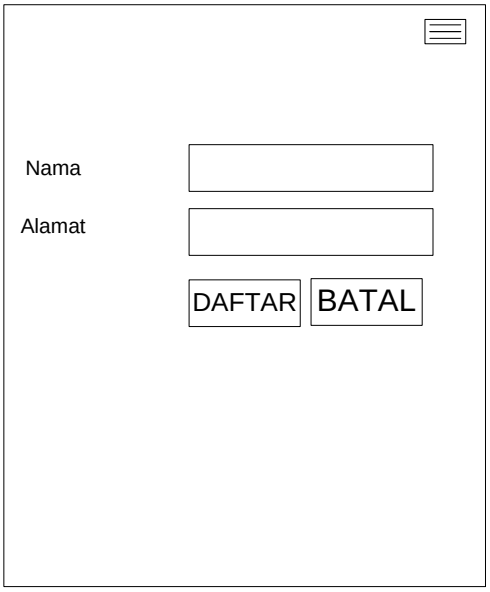
Below is an expert system design display for identifying the quality of crystal guava seedlings based on mobile web with forward chaining. The database used is MySQL. The design process will be run by the system so that it can obtain input and output information from the system in the form of information.

a. Home Page Design



Picture 1.4 Home Page

b. Login and register page design



Picture 1.5 Login and register page

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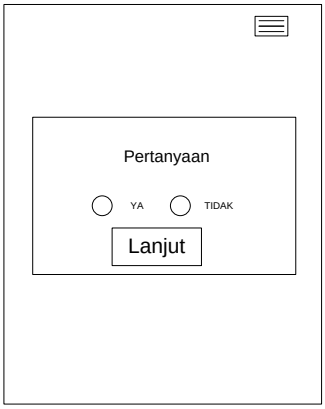
c. Consultation page design

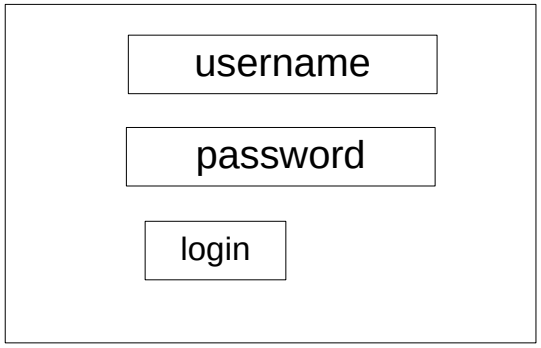


Picture 1.6 Consulting input design

d. Consultation result design

Picture 1.7 Consultation output page design

e. Admin login page design



Picture 1.8 Admin login

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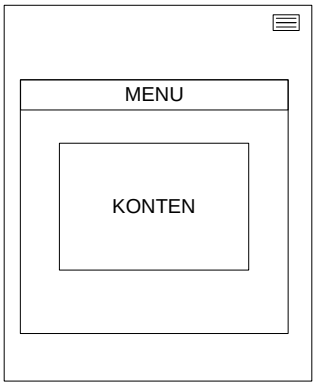
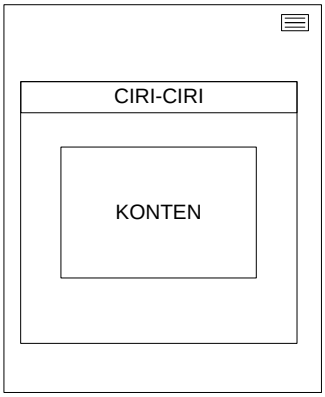
f. Admin homepage design



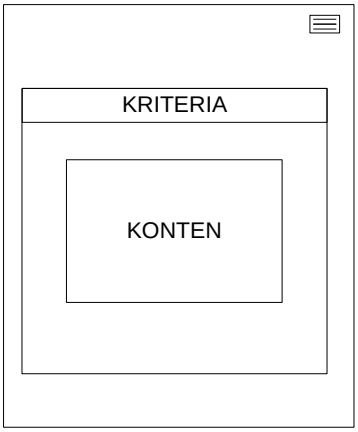
Picture 1.9 Admin homepage

g. Admin seed feature page design



Picture 1.10 Seed characteristics

h. Admin criteria page design



Picture 1.11 Criteria

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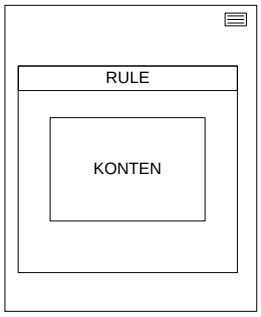
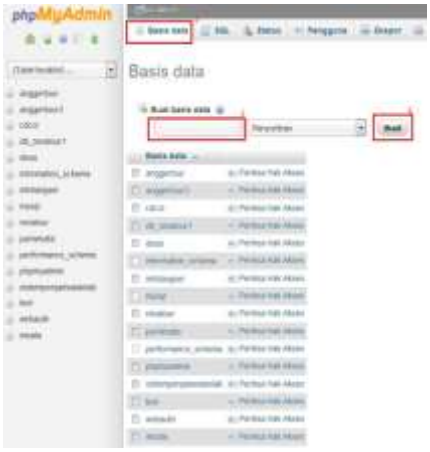
i. Admin rule page design



Picture 1.12 Rule

4.2 Implementation

When building an expert system to identify the quality of crystal guava seeds based on mobile web, the first step to be completed is to create a database first.



Picture 1.13 Creating Database Tables

Then after creating the database, the results of the database tables that have been created come out.

Picture 1.14 Database

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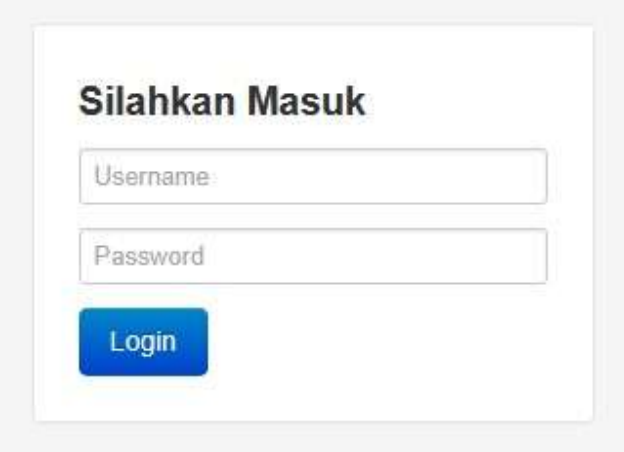
4.2 Discussion

a. Login

Below is the admin login page to open the website:



Picture 1.15 Admin login

Admin login page is used to enter username and password.

b. Admin home

Picture 1.16 Admin home

The home page is the front view of a website that is used to display temporary information.

c. Input admin

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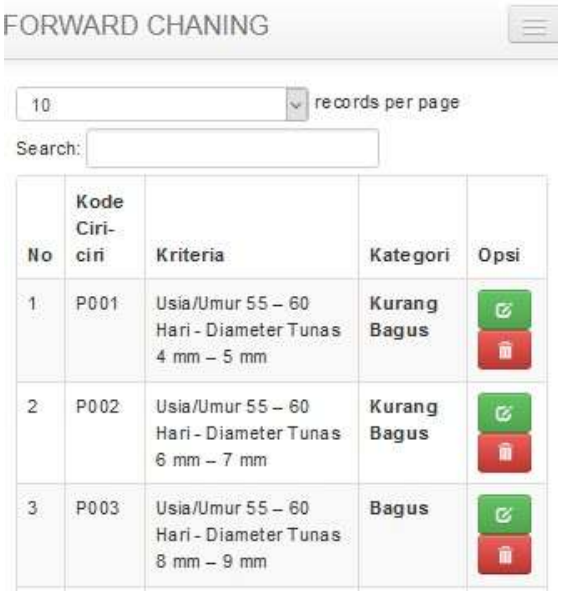
Picture 1.17 Admin features

The seed characteristics page is used to determine the characteristics of good quality seeds and good for the development of crystal guava seeds.

d. Input admin criteria



Picture 1.18 Input admin criteria

The criteria input page is used to find out the best quality crystal guava seeds.

e. Input Rule Admin

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Picture 1.19 Input Rule admin

The rule page is used to find out the results of the consultation which are calculated from the characteristics, criteria, and solutions, then the rule will calculate the results of all.

f. Code and feature names

LAPORAN DATA CIRI-CIRI

No	Kode Ciri-ciri	Nama Ciri-ciri
1	G001	daun berwarna hijau cerah
2	G002	benih di ambil dari pohon unggul
3	G003	bibit berasal dari cangkok atau stek
4	G004	bibit terhindar dari penyakit
5	G005	ada bekas sambungan pada batang
6	G006	akar serabut yang sangat banyak

Picture 1.20 code and name of admin characteristics

The code page and the name of the characteristics are used to find out a list of all the characteristics of crystal guava seeds.

g. Home users

Picture 1.21 Home users

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The user home page is the main display page for displaying information.

h. User login

Picture 1.22 User login

This page is used to register users, so that users can login to the mobile web expert system.

i. Consultation

Picture 1.23 User Consultation

The consultation page is used by farmers to consult about the quality of the best crystal guava seeds.

j. Output Result

Picture 1.24 User output results

The results output page, where farmers can find out the results of the consultation that have been answered from the previous question.

k. Report

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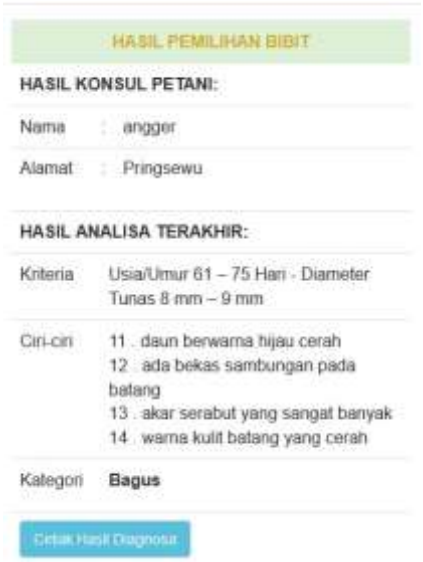

Picture 1.25 User reports

The report page is used to find out and print the report results after consultation following the characteristics and criteria experienced by farmers, then from these results, it can be known the age or age, diameter, shoots of these characteristics and criteria. Testing is done by comparing the results of calculations from the existing rules in the system with the diagnostic results from experts. Based on the comparison between the diagnostic results from the calculation of the rules in the system and the diagnostic results from the expert, the results are as follows: The test results show that the implementation of forward chaining in the expert system to detect the quality of crystal guava seeds has worked well.

5. CONCLUSION

From the discussion above, it can be concluded as follows:

1. With this mobile web-based expert system, it can make it easier for farmers to choose quality crystal guava seeds.
2. The result of this system is information about the parameters of good and bad seedlings which are determined based on age standards and branch diameters based on scientific concepts.

Suggestion

Based on the above discussion regarding an expert system to identify the quality of crystal guava seeds based on mobile web with forward chaining. The suggestions that the author can give include:

1. It is hoped that further research can develop with android-based applications or with other methods for the perfection of this research.
2. For further development, it would be better if the web appearance was made more attractive from the color composition and writing.

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