DISEASE DETECTION EXPERT SYSTEM IN WATERMELON PLANTS USING CERTAINTY FACTOR METHOD BASED ON MOBILE

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Abstract—Watermelon is one of the fruit commodities currently being developed in West Nusa Tenggara by making Central Lombok Regency a production center. The problems that farmers often face in conducting watermelon farming besides pest attacks, watermelon plants are also often affected by diseases which cause the plants to wilt then dry, white spots on the fruit flesh, growth of leaves and small fruit so that it has an impact on decreased productivity caused by a lack of knowledge farmers in recognizing and dealing with diseases in watermelon plants so that they are often mishandled. This research was conducted to produce an expert system that can detect diseases in watermelon plants and provide solutions for handling them so that watermelon farmers can make prevention and handling efforts quickly before the disease spreads to many other watermelon plants. This expert system was built using the mobile-based Certainty Factor Method with the Android operating system so that it can be downloaded on the Playstore by watermelon farmers or anyone who needs it so. That it is hoped that it can help farmers detect diseases in watermelon plants and provide appropriate handling steps based on related theory.

Keywords: Expert System, Watermelon Plant Disease, Certainty Factor, Mobile.

Abstrak— Semangka adalah salah satu komoditi buah yang saat ini dikembangkan di Nusa Tenggara Barat dengan menjadikan Kabupaten Lombok Tengah sebagai sentra produksinya. Permasalahan yang sering dihadapi petani dalam melakukan usaha tani semangka selain adanya serangan hama, tanaman semangka juga sering terkena penyakit yang menyebabkan tanaman menjadi layu kemudian kering, bercak putih pada daging buah, pertumbuhan daun dan buah kecil sehingga berdampak pada turunnya produktivitas yang disebabkan karena kurangnya pengetahuan petani di dalam mengenali dan menangani penyakit pada tanaman semangka sehingga seringkali salah dalam penanganan. Penelitian ini dilakukan dengan tujuan untuk menghasilkan sistem pakar yang dapat digunakan untuk mendeteksi penyakit pada tanaman semangka dan memberikan solusi penanganannya sehingga petani semangka dapat melakukan upaya-upaya pencegahan dan penanganan dengan cepat sebelum penyakit menular ke banyak tanaman semangka lainnya. Sistem pakar ini dibangun dengan Metode Certainly Factor berbasis mobile dengan sistem operasi Android sehingga dapat diunduh di Playstore oleh petani semangka atau siapapun yang membutuhkannya sehingga diharapkan dapat membantu petani dalam mendeteksi penyakit pada tanaman semangka dan memberikan langkah-langkah penanganannya yang tepat didasarkan pada teori terkait.

Kata Kunci : Sistem Pakar, Penyakit Tanaman Semangka, Certainty Factor, Mobile.

INTRODUCTION

Central Lombok Regency is one of the regencies in West Nusa Tenggara Province, which consists of 12 sub-districts with a total area of 120,839 Ha, of which 105,559 Ha (87.35%) is agricultural land. In addition to rice and corn, the agricultural sector developed in horticulture, including fruits and vegetables. One of the fruit commodities currently being developed is watermelon, which Central Lombok Regency is the center of watermelon production in NTB, with a planting area of 557 hectares and a total production of 158,743 Kw (Iskandar, 2019). Watermelon is a nutritious food with many vitamins and minerals, high levels of antioxidants, and few calories. Watermelon contains about 90% water. Watermelon is an annual plant that belongs to the cucurbitaceae family so that it still has a kinship with melon (Cucumis melo L.), cucumber (Cucumis

sativus L.), chayote (Sechium edule (Jacq) Sw.), water gourd (Lagenaria siceraria (Lagenaria siceraria). Mol) Standl.), and pumpkin (Cucurbita moschata Dutch ex Poir) are vines native to semi-desert areas of Southern Africa (Handayani & Taufik, 2017). This plant is suitable to be developed in the province of NTB because it is a tropical plant, grows in the lowlands up to 30 meters above sea level, and requires soil with a fairly high organic content. This watermelon farming business can be developed in rainfed rice fields or in dry land so it is suitable to be developed in NTB, which has a fairly large dry land (Firdaus, Dahlan, & Silawibawa, 2021).

Based on information obtained from interviews with watermelon farmers at UD Sasak Tani. The problems farmers face in watermelon farming, in addition to pest attacks, watermelon plants are also often affected by diseases that cause plants to wither and dry, white spots on fruit flesh, growth leaves, and small fruit with an impact on the decline in productivity. From the interviews, the researchers concluded that farmers' lack of knowledge in recognizing and dealing with diseases in watermelon plants is often wrong in handling.

Expert systems are part of computer science that aims to transfer human intelligence to machines. In artificial intelligence, an expert system is a system that uses the knowledge possessed by humans to solve problems (Nasser & Naser, 2018), so that the expert system imitates the decision-making abilities of an expert in a particular domain and can also provide advice and explanations (Sutojo, Edy, & Suhartono, 2011). One method in expert systems that have been commonly used is the certain factor method (Turban & Aronson, 2001). Several studies have been conducted using the Certainty Factor Method on the watermelon plant detection expert system. The certainty Factor is a method that defines a measure of certainty against facts or rules to describe an expert's belief in the problem at hand (Suyanto, 2021). This method is used to prove whether a fact is certain or not in the form of a metric that is usually used in expert systems (Elsharif & Naser, 2010). The advantages of the Certainty Factor Method are: 1) This method is suitable for measuring something whether it is certain or not, for example in an expert system for detecting a disease, 2) Calculations carried out in one count can only process two data so that the accuracy of the data can be maintained (Ramadhan & S.Pane, 2018). Some of these previous studies, namely: research conducted by Sandy Kosasih in 2014 entitled Expert System for Diagnosing Watermelon Pests and Diseases Using Certainty Factor Methods (Kosasi, 2014), research conducted by Tika Wuladari et al in 2018 entitled: Design Website-Based Watermelon Plant Growth Detection Expert System With Certainty Factor (Wulandari, Sari, Novita Sari, & Isnandar, 2018), research conducted by Muhammad Yunus et al. in 2019 entitled: Application of Certainty Factor Methods to Diagnose Diseases in Watermelon Plants (Yunus, Apsiswanto, & Saprudin, 2019) research conducted by Alan Wiedy Mariana in 2019 entitled: Expert System for Diagnosis of Watermelon Plant Diseases Using the Certainty Factor Method (Wiedy Mariana, 2019). The four previous studies both used the Certainty Factor Method to detect pests and diseases on watermelon plants, the difference lies in the following points:

a. In terms of the disease to be studied

Sandy Kosasi (2014) tested the confidence level for pests, Tika Wuladari et al. (2018) for fusarium oxysporum, Muhammad Yunus et al. (2019) for powdery mildew, and Alan Windy Mariana (2019) for dumping-off disease, while in this study What will be tested is the level of confidence for the types of anthracnose and bacterial fruits blotches.

b. In terms of research conducted

This study will use six disease data and 22 symptom data, where the number of symptom data used is more than the four previous studies.

c. In terms of the application used

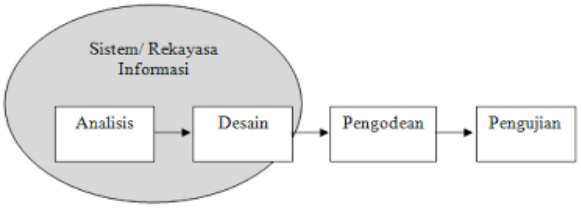
Research conducted by Sandy Kosasih (2014) uses the Visual Basic.Net programming language from the side of the user interface, which is less attractive and does not meet the usability aspect, and is difficult to diffuse to the community. Research conducted by Tika Wuladari et al. (2018), Muhammad Yunus et al. (2019), and Alan Wiedy Mariana (2019) use a web programming language in terms of an attractive and user-friendly user interface, but it is still not practical because users have to type in the URL every time they want to use the web. use it. While the research that the researcher will do later will use a mobile-based application with the Android operating system so that it will facilitate the diffusion of innovation and educate farmers because the application can be downloaded on the play store for free by anyone and once installed on a mobile device, the application can be used easily. anytime and anywhere without having to type in the URL every time you use it.

Considering the increasing number of watermelon farmers with increasing planting area, not only in Central Lombok but now also starting to be developed in North Lombok Regency and it is possible in other districts in NTB as well as watermelon farmers in other provinces in Indonesia researchers feel the need for an application that can be used to detect diseases in watermelon plants and provide solutions for handling them so that watermelon farmers can make prevention and treatment efforts quickly before the disease is transmitted to many other watermelon plants. This application will be built on a mobile-based basis

with the Android operating system so that it can be downloaded on Playstore by watermelon farmers or anyone who needs it so. That it is hoped that it can help farmers detect diseases in watermelon plants and provide appropriate handling steps based on related theories.

RESEARCH METHODS

The method used in this study is a software development method with the Waterfall Method. The Waterfall method provides a sequential or sequential software life flow approach starting from analysis, design, coding, and testing (Rosa & Shalahuddin, 2018). The Waterfall method is often also called a linear sequential model or a classical life cycle. The Waterfall method is shown in Figure 1.



Source: (Rosa & Shalahuddin, 2018)

Figure 1. Stages in the Waterfall Method

The explanation of each stage in the Waterfall Method is as follows:

1. Analysis Stage

The analysis carried out at this stage is an analysis of software requirements which is carried out by collecting data and information through interviews with system users (users), namely watermelon farmers at UD Sasak Tani, agricultural extension workers from the Agriculture Service of Central Lombok Regency.

2. Design Stage

Activities at this stage are designing algorithms for testing using the Certainty Factor method and designing user interfaces. The algorithm for the watermelon disease detection using Certainty Factors is:

a. Start
b. Take all the symptoms that define the disease.
c. Query form to perform symptom search.
d. Ask about all the symptoms of the disease to the user.
e. Save the user's (CF) answer into the $temp variable.
f. Find the minimum value of the user CF set in the $temp variable.
g. Find the Final CF value of each disease name rule. The form of the search formula is: CFFinal = CFUser * CF Expert.
h. Show disease conclusion.
i. End

The determination of watermelon plant diseases with the Certainty Factor is based on the decision table in Table 1 below.

Table 1. Table of disease decisions on watermelon plants

Symptom	Disease					
	P01	P02	P03	P04	P05	P06
There are black spots on the skin of the fruit	√					
The fruit rots, but the rotten parts remain hard or dry rot	√					
Old fruit will crack or break	√					
The fruit gradually rots	√					
There are larvae in the fruit	√					
The taste of the fruit is not good. A little sour	√	√				
Bad-smelling fruit that smells bad	√	√				
Terdapat busuk basah dengan ukuran kecil diameter kurang dari 1 cm		√				
There is wet rot with a small size of less than 1 cm in diameter		√				
The old fruit has a corky brown scab		√				
Fruit secretes liquid		√				
There are spots on the leaves			√	√		√
The outside spots are brown, while the inside is light brown			√			
Round spots			√			
Angled yellow spots				√		
Leaves dry and crumble easily				√		
The leaves are blistered and crushed					√	
Striped leaves					√	
Cracks appear on the stem					√	
Dwarf plant						
Yellow spots then turn brown						
There are fine grey tassels						

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Source : (Juhartini et al., 2022)

The description of the code for the type of disease is as follows:
P01: Rotten Fruit (Anthracnose)
P02: Fruit Ulcer (Bacterial Fruit Blotch)
P03: Crackle (Anthracnose)
P04: Feather Dew (Downy Mildew)
P05: Leaf Rust
P06: Leaf Spot

3. Coding Stage

The coding stage is carried out to produce an expert system for detecting watermelon diseases based on mobile, named the watermelon expert system.

4. Testing Stage

Functionality testing is carried out to determine whether there is an error or not in the application made and to determine the suitability between the resulting application and the desired one by using the Black Box Method and usability testing to determine the level of usability of the software for a group of people, which is carried out on seven farmers who are members of the UD Sasak Tani.

IMPLEMENTATION AND TESTING

1. Implementation Result

The resulting watermelon expert system has the following screen display.
On the dashboard, the user will display the total symptoms, disease, knowledge, and users, as shown in Figure 1. To diagnose the disease, the user presses the green start button at the bottom.

Source : (Juhartini et al., 2022)
Figure 1. Dashboard display

After pressing the start button, a diagnosis form will appear containing a list of symptoms, as shown in Figure 2.

Source : (Juhartini et al., 2022)
Figure 2. Display of the Diagnosis Form

Instructions for filling can be seen by pressing the information icon at the top right of the form. After the user finishes selecting the symptoms experienced by the watermelon plant, the user presses the process button, and the diagnostic results will appear in the form of symptoms, disease details, control, and other possibilities, as shown in Figures 3 and 4 below.

Source : (Juhartini et al., 2022)
Figure 3. Display of Diagnostic Results

Source : (Juhartini et al., 2022)

Figure 4. Display of Advanced Diagnostic Results

To close the screen, the user can press the close button at the bottom of the form, and a history of disease detection that the user has done will appear.

2. Testing

a. Testing with the Certainty Factor Method

Each disease symptom in watermelon plants has a weighting of MB and MD values. This value weight represents an expert's belief in a symptom that affects the occurrence of a particular disease. MB is the value of confidence in symptoms, while MD is the value of distrust of symptoms. The symptom weights obtained from the results of the study are listed in Table 2 below:

Table 2. Symptom Weighting

No	Disease Name	Symptom	MB	MD
1	Rotten Fruit *(Antranoksa)*	There are black spots on the skin of the fruit	0.7	0.3
		The fruit rots, but the rotten parts remain hard or dry rot	0.8	0.2
		Old fruit will crack or break	0.9	0.1
		There are larvae in the fruit	0.7	0.3
		The taste of the fruit is not good. A little sour	0.9	0.1
		Bad-smelling fruit that smells bad	0.9	0.1
2	Fruit Boils *(Bacterial Fruits Blotch)*	There is wet rot with a small diameter of less than 1 cm	0.9	0.1
		The surface of the fruit becomes completely rotten	0.7	0.3
		The old fruit has a corky brown scab	0.8	0.2
		The taste of the fruit is not good. A little sour	0.9	0.1
		Fruit secretes liquid	0.7	0.3
		Bad-smelling fruit that smells bad	0.9	0.1
3	Crackle *(Antraknosa)*	There are spots on the leaves	0.9	0.1
		The outside spots are brown, while the inside is light brown	0.6	0.4
		Round spots	0.9	0.1
4	Feather Dew *(Downy Mildew)*	There are spots on the leaves	0.9	0.1
		Angled yellow spots	0.9	0.1
		The leaves dry up, and the leaves are easily crushed	0.9	0.1
5	Leaf Spots	There are spots on the leaves	0.9	0.1
		Yellow spots then turn brown	0.6	0.4
		There are fine grey tassels	0.9	0.1
6	Leaf Rust	The leaves are blistered and crushed	0.9	0.1
		Striped leaves	0.9	0.1
		Cracks appear on the stem	0.9	0.1
		Dwarf plant	0.9	0.1

Source : (Juhartini et al., 2022)

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The application of the formulation of the level of certainty of disease in watermelon plants, namely Bacterial Fruits Blotch, which is indicated by symptoms and answers to the belief of symptoms for the disease as follows:

1. There is wet rot with a small diameter of less than 1 cm: **Almost Definitely Yes**
2. The old fruit has a corky brown scab: **Definitely, Yes**
3. Fruit oozes fluid: **Maybe Yes**
4. The taste of the fruit is not good, a little sour: **Definitely Yes**
5. Fruit that smells bad smells bad: **Definitely Yes**
6. The surface of the fruit becomes completely rotten: **Definitely Yes**

Furthermore, based on the user's choice of answers, the initial rule has six premises (symptoms) broken down into rules with a single premise and the same premise.
Rule 1.1
IF There is wet rot with a small diameter of 1 cm, THEN Bacterial Fruits Blotch
Rule 1.2.
IF Old fruit has a brown scab with cork, THEN Bacterial Fruits Blotch
Rule 1.3
IF Fruit discharge, THEN Bacterial Fruits Blotch
Rule 1.4
IF Bad taste of the fruit is slightly sour, THEN Bacterial Fruits Blotch AND Fruit rot (Anthranoxa)
Rule 1.5
IF Bad-smelling fruit, THEN Bacterial Fruits Blotch AND Fruit rot (Anthranoxa)
Rule 1.6
If the fruit's surface becomes completely rotten, THEN Bacterial Fruits Blotch.

Determine the CF value for each symptom of Bacterial Fruits Blotch as follows:
CF 1.1 (There is wet rot with a small diameter of 1 cm)
CF(h,e) = MB(h,e) – MD(h,e)
= 0.9 – 0.1 = 0.8
CF 1.2 (Older fruit has a corky brown scab)
CF(h,e) = MB(h,e) – MD(h,e)
= 0.8 – 0.2 = 0.6
CF 1.3 (Fruit oozes fluid)
CF(h,e) = MB(h,e) – MD(h,e)
= 0.7 – 0.3 = 0.4
CF 1.4 (Unpleasant fruit tastes slightly sour)
CF(h,e) = MB(h,e) – MD(h,e)
= 0.9 – 0.1 = 0.8
CF 1.5 (Fruit smells bad smelling bad)
CF(h,e) = MB(h,e) – MD(h,e)
= 0.9 – 0.1 = 0.8
CF 1.6 (Fruit surface becomes completely rotten)
CF(h,e) = MB(h,e) – MD(h,e)
= 0.7 – 0.3 = 0.4
The next step is calculating the CF value by multiplying CF(user) by CF(expert).
CF(P,E) = CF(user) * CF(expert)
CF 1.1 = 0.8 * 0.8 = 0.64
CF 1.2 = 1 * 0.6 = 0.6
CF 1.3 = 0.4 * 0.4 = 0.16
CF 1.4 = 1 * 0.8 = 0.8
CF 1.5 = 1 * 0.8 = 0.8
CF 1.6 = 1 * 0.4 = 0.4

Then combine the CF values from each rule, namely combining CF 1.1 with CF 1.2 with the following formula:
CFcombine (CF1.1 , CF 1.2) = CF1.1 + CF1.2 (1-CF1.1)
= 0.68 + 0.6 (1 - 0.68) = 0.872
Combine CFold with CF1.3
CFcombine (CFold and CF1.3) = 0.872 + 0.16 (1-0.872) = 0.89248
Combine CFold2 with CF1.4
CFcombine (CFold2 and CF1.4) = 0.89248 + 0.8 (1 – 0.89248) = 0.978496
Combine CFold3 with CF1.5
CFcombine (CFold3 and CF1.5) = 0.978496 + 0.8 (1 – 0.978496) = 0.9956992
Combine CFold4 with CF1.6
CFcombine (CFold4 and CF1.6) = 0.9956992 + 0.4 (1-0.9956992) = 0.99741952 = 0.997

The calculation results show the certainty value of watermelon plants suffering from Bacterial Fruits Blotch with a confidence level of 0.997.
Determine the CF value for each symptom of fruit rot disease (Anthracnose) as follows:
CF 1.4 (Unpleasant fruit tastes slightly sour)
CF(h,e) = MB(h,e) – MD(h,e)
= 0.9 – 0.1 = 0.8
CF 1.5 (Fruit smells bad smelling bad)
CF(h,e) = MB(h,e) – MD(h,e)
= 0.9 – 0.1 = 0.8
The next step is calculating the CF value by multiplying CF(user) by CF(expert).
CF 1.4 = 1 * 0.8 = 0.8
CF 1.5 = 1 * 0.8 = 0.8
Finally, combine the CF value of CF 1.4 with CF 1.5 with the following formula:
CFcombine (CF1.4 , CF 1.5) = CF1.4 + CF1.5 (1-CF1.4)
= 0.8 + 0.8 (1 - 0.8) = 0.960

The calculation results show the certainty value of watermelon plants suffering from fruit rot disease (Anthranoxa) with a confidence level of 0.960.
From the results of the calculations above, the respective Certainty Factor (CF) values are obtained, namely:
1. Bacterial Fruits Blotch = 0.997
2. Rotten Fruit (Anthracnose) = 0.960

So the conclusion of the disease suffered by watermelon plants from one of the respondents is Bacterial Fruits Blotch with a confidence value of 0.997. This case is tested into the system, and the system gives the same output. With this, the Certainty Factor calculation performed by the system is correct.

b. Functionality and Usability Testing

Functionality testing is carried out using the Black Box method, with test results showing no error in the application created and the application is as expected, so it can be concluded that the system as a whole is regular. Usability testing was carried out on seven farmers who are members of UD Sasak Tani and an agricultural expert from the Agriculture Service of Central Lombok Regency. The application suitability assessment instrument consists of 10 questions with assessment indicators covering display design, ease of use, completeness, applicability, interactive, impactful, and effectiveness. The result of filling out the questionnaire is an average index of 94%, and an expert system for detecting diseases in watermelon plants is very feasible because it fits the needs.

CONCLUSION

Based on the results and discussions that have been described, the following conclusions can be drawn:
This mobile-based watermelon expert system was built to make it easier for watermelon farmers to detect diseases in watermelon plants so that farmers can properly make healing and prevention efforts to produce quality watermelons and increase agricultural productivity. This expert system can be downloaded on Google Playstore for free so that it can be used by anyone who needs it. The results of functionality testing in an average index of 94% indicate that the resulting watermelon expert system application has met display design, ease of use, completeness, applicability, interaction, impactful, and effectiveness with perfect criteria.

REFERENCES

Elsharif, A. A., & Naser, S. S. A. (2010). An Expert System For Diagnosing Sugarcane Diseases. *International Journal for Academic Development*, *3*(3), 19–27. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3369014

Firdaus, S., Dahlan, H. ., & Silawibawa, P. (2021). *Karakterisasi Lahan Penanaman Semangka di Kecamatan Kopang Kabupaten Lombok Tengah* (Universitas Mataram). Universitas Mataram. Retrieved from http://eprints.unram.ac.id/4151/1/jurnal.pdf

Handayani, M., & Taufik. (2017). Sistem Pakar Diagnosa Penyakit Tanaman Semangka Menggunakan Metode Dempster Shafer Berbasis Web. *Progresif*, *13*(2), 1727–1734. Retrieved from http://ojs.stmik-banjarbaru.ac.id/index.php/progresif/article/view/163

Iskandar, L. (2019). *Profil Dinas Pertanian: Informasi Capaian Pembangunan dan Statistik*. Lombok Tengah: DInas Pertanian Lombok Tengah.

Juhartini, Arwidiyarti, D., & Subki, A. (2022). *Laporan Akhir Penelitian : Sistem Pakar Pendeteksi Penyakit Pada Tanaman Semangka Menggunakan Metode Certainly Factor Berbasis Mobile.* Mataram.

Kosasi, S. (2014). Sistem Pakar Diagnosa Hama dan Penyakit Tanaman Semangka Menggunakan Metode Certainty Factor. *Seminar Nasional Pengaplikasian Telematika SINAPTIKA*, 180–184. Jakarta. Retrieved from https://journal.binadarma.ac.id/index.php/jurnalmatrik/article/view/1764

Nasser, B. S. A., & Naser, S. S. A. (2018). Rule-Based System for Watermelon Diseases and Treatment. *International Journal of Academic Information Systems Research*, *2*(7), 1–7. Retrieved from IJAISR180701.pdf

Ramadhan, P. S., & S.Pane, U. F. (2018). *Mengenal Metode Sistem Pakar*. Ponorogo: Uwais Inspirasi Indonesia.

Rosa, A. S., & Shalahuddin, M. (2018). *Rekayasa Perangkat Lunak Terstruktur dan Berorientasi Objek*. Bandung: Informatika.

Sutojo, T., Edy, M., & Suhartono, V. (2011). *Kecerdasan Buatan*. Yogyakarta: Andi Offset.

Suyanto. (2021). *Artificial Intelligence* (3 rd). Bandung: Informatika.

Turban, E., & Aronson, J. E. (2001). *Decision Support System and Intelligent System* (6th ed.). New Jersey: Prentice Hall, Inc.

Wiedy Mariana, A. (2019). Sistem Pakar Diagnosis Penyakit Tanaman Semangka Menggunakan Metode Certainty Factor. *Jurnal Mahasiswa Teknik Informatika (JATI)*, *3*(1), 24–30. Retrieved from https://ejournal.itn.ac.id/index.php/jati/article/download/486/460

Wulandari, T., Sari, S. P. G. Y. K., Novita Sari, D., & Isnandar, S. (2018). Perancangan Sistem Pakar Deteksi Pertumbuhan Tanaman Semangka Berbasis Website Dengan Certainty Factor. *Technology Acceptance Model*, *9*(2), 134–141. Retrieved from https://ojs.stmikpringsewu.ac.id/index.php/JurnalTam/article/view/683/607

Yunus, M., Apsiswanto, U., & Saprudin, U. (2019). Penerapan Metode Certainty Factor Untuk Mendiagnosa Penyakit Pada Tanamah

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Semangka. *International Research On Big-Data and Computer Technology*, *3*, 1–6. Retrieved from https://doi.org/10.53514/IR.V3I1.150.