Journal of Computer Science and Information Technology
https://jcsitech-upiyptk.org/ojs
2024 Volume 10 Issue 2 Pages 55-59 e-ISSN: 2502-1486

Application of an Expert System with the Breadth First Search (BFS) Method in Diagnosing Areca Plant Diseases

Ferry Juliandri Pane*, Eva Rianti, Hari Marfalino
Universitas Putra Indonesia YPTK Padang, Jl. Raya Lubuk Begalung Padang, Sumatera Barat – 25221, Indonesia
* ferrypane025@gmail.com

Abstract

Current technological developments are growing very quickly and have produced a lot of software or systems that can make things easier for humans. Continuous scientific progress drives extensive technological development. One form of information technology known is an information system. One popular type of information system is an expert system, which can be used to improve various services. An expert system is a program that combines human knowledge into a computer to help solve problems that are usually solved by experts. This research aims to identify gaps in research that has been conducted, as well as encourage the development of new ideas and increase capabilities in utilizing existing research resources. Areca nut is a high agricultural resource so it has many benefits in the pharmaceutical industry. . The method that will be used in this research is Breadth First Search (BFS). The algorithm carries out the search process on all nodes that are at the same level or hierarchy one by one. An algorithm that performs a wide search that visits nodes in preorder, that is, visits a node first. There are 16 data on areca plant diseases here and have 33 symptoms which will be processed using the Breadth First Search Method. By diagnosing areca plant diseases using an expert system, it is hoped that we can find more in-depth information about diseases in areca palm trees.

Keywords: Expert System, Breadth First Search (BFS), Areca Nut, Knot, Disease.

1. Introduction

Areca nut is known as an industrial plant that has many benefits for humans. Because from the roots to the fruit, everything can be used for human needs. Areca nut is a high agricultural resource so it has many benefits in the pharmaceutical industry. Areca nut is widely used as a mixture of traditional medicines and is even processed into natural dyes[1][2].

One factor in the low development and productivity of areca nut plants is the lack of knowledge and information possessed by cultivators and the public regarding pests and diseases that attack areca nut plants and how to deal with them. Limited time and a lack of experts in this matter are obstacles in cultivating areca palm plants [3][4].

The Breadth First Search algorithm is an algorithm that has the simplest flow5][6]. The algorithm carries out a search process on all nodes that are at the same level or hierarchy one by one, the nodes expand from left to right sequentially based on the level of the node first. before continuing the search process at the node at the next level. If at one level the desired solution has not been found, the search continues to the next level. And so on until a solution is found, then, in this way, the method guarantees that a solution will be found if the solution does exist [7].

Expert systems are a branch of artificial intelligence that is quite old because this system began to be developed in the mid-1960s. This system works to adopt human knowledge to computers that combine basic knowledge to replace an expert in solving a problem [8][9][10]. With an expert system, even lay people can solve quite complex problems that can only be solved with the help of experts. For experts, expert systems will also help their activities as very experienced assistants [11].

An expert system is a system that adopts the knowledge of experts or experts in a particular field into a computer, so that the computer is able to solve problems that are usually solved by experts. Expert systems involve knowledge, facts and ways of thinking in solving problems which are usually solved by experts in their field [12][13].

Breadth first search is an algorithm that performs a broad search that visits nodes in preorder, that is, visiting a node first [14][15] . Next, nodes that have not been visited are neighboring nodes that have previously been visited, and so on. If the graph is in the form of a rooted tree, then all vertices at level d are visited first before the vertices at level d+1 [16].

Accepted: 02-15-2023 | Revised: 03-15-2023 | Published: 04-30-2024| doi: 10.35134/jcsitech.v10i2.102

This algorithm requires a queue q to store the nodes that have been visited. These nodes are needed as a reference for visiting neighboring nodes. Each node that has been visited enters the queue only once. This algorithm also requires a Boolean table to store the nodes that have been visited so that no node is visited more than once [17].

An example of the Breadth First Search algorithm tree can be seen below:

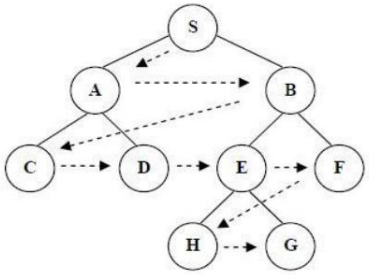

Figure 1 Breadth First Search Flow

Previous research by Gustina et al on Diagnosing Diseases in Hydroponic Green Mustard Vegetable Plants Using the Depth First Search (DFS) Algorithm. This research shows that the DFS algorithm can diagnose diseases in hydroponic mustard greens plants. The DFS algorithm is able to explore all the symptoms shown by the system chosen based on complaints from hydroponic farmers [18]. Hanan Hussein et al also conducted research on epth-first-search-tree based D2D power allocation algorithms for V2I/V2V shared 5G network resources, where in this research the DFST algorithm was used to regulate V2I/V2V channel assignment procedures to increase network utilization. Simulation results demonstrate the efficiency of the proposed algorithm. By guaranteeing a lower bound on V2I ergodic capacity, OPT-DFST algorithm shows better network bandwidth with effective runtime than other algorithms. It is also capable of operating even at an increased number of V2V per channel[19].

By diagnosing areca plant diseases using an expert system, it is hoped that we can find more in-depth information about diseases in areca palm trees. With this expert system, it is hoped that it will make it easier for areca nut farmers to identify cashew diseases occurring in areca palm plants

2. Research methodology

The research framework is the concept or stages that will be carried out in the research. So that the steps taken by the author in this design do not deviate from the main discussion and are easier to understand, the sequence of research steps will be made systematically so that it can be used as a clear and easy guide for solving existing problems. In the DFS algorithm, the search is carried out at one node in each level from the leftmost one. If at the deepest level a solution has not been found, then the search continues at the node on the right. The node on the left can be deleted from memory. If at the deepest level a solution has not been found, then the search continues to the next level previously . And so on until a solution is found. If a solution is found, there is no need for a backtracking process (searching to get the desired path). For example, a problem state space is shown in Figure 2 below:

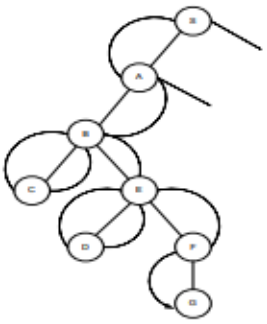

Figure 2. Research Framework

In a search using the Depth First Search (DFS) algorithm, the deepest nodes in the tree will be searched first. For example, Figure 2. The initial search sequence (S) to the goal state (G) is starting from node S, then to node A, then to node B, then to node C, after that it will go to node E, then go to node D , after that it will go to node F after passing node E, and the last one will go to node G.

3. Results and Discussion

3.1 Analysis and Results

1. Pentakit Data

The disease data that has been determined along with the disease code can be seen below.

Table 1 Disease Data

No	Code Disease	Name Disease
1.	P01	Spotting Leaf
2.	P02	*Leaf blight*
3.	P03	Rust red leaf (*ed rust*)
4.	P04	Rotten root/base stem
5.	P05	Rotten fruit
6.	P06	Shoot rot (*Bud Roof*)
7.	P07	Withered shoots
8.	P08	Foot rot (*Foot rot*)
9.	P09	Fruit drops
10.	P10	Cecum black (*Bacterial leaves stripes)*
11.	P11	Leaf shrinking (*Band*)
12.	P12	Stem bloody (*Stem Bleeding*)
13.	P13	Fruit cracked (*Nut splitting)*

2. Symptom Data

The disease data that has been determined along with the disease type can be seen below.

Table 2 Symptom Data

No.	Code Symptom	Name Symptom
1.	G01	Spots yellowish on lamina leaf
2.	G02	Leaf become spots yellow, then green
3.	G03	End leaf changed color chocolate
4.	G04	Midrib leaf remaining stick
5.	G05	Color leaf become withered pale
6.	G06	Leaves become short and broom-shaped
7.	G07	Stem leaf yellow brass
8.	G08	End leaf become withered And colored yellow
9.	G09	Root stem areca changed become chocolate yellowish
10.	G10	Spotting wet on surface fruit near petals flower
11.	G11	Change color of yellow pale on leaves oldest until leaf youngest
12.	G12	Color fruit transformed into green old
13.	G13	Part apical end fruit causes fruit fall
14.	G14	Part shoots changed yellow chocolate
15.	G15	Shoot rot with smell typical
16.	G16	Entire corolla withering away suddenly
17.	G17	Midribs hanging leaves And Finally fall
18.	G18	The plant will no longer have a crown
19.	G19	Leaves turn yellow and droop
20.	G20	Plant roots rot
21.	G21	The tips of the leaves turn yellow
22.	G22	The female flowers will fall
23.	G23	The leaves show dark green spots
24.	G24	The underside of the leaf is covered in bacteria
25.	G25	The leaves are irregular and turn grayish white
26.	G26	The leaf stem is tapered
27.	G27	The distance between stem segments shortens
28.	G28	The crown of the tree turns into a rose
29.	G29	Dark red discoloration on the stem
30.	G30	The stem tissue secretes a dark brown fluid
31.	G31	The color of the fruit is yellowish when the fruit is half ripe
32.	G32	The color of the leaves becomes dull
33.	G33	The stem spots ooze fluid

3. Rule

Rule 1
If G1 AND G2 AND G3 AND G4 AND G5 AND G6 AND G7 AND G8 AND G19 THEN P1
Rule 2
If G1 AND G5 AND G6 AND G8 THEN P2

Rule 3
If G1 AND G4 AND G7 AND G8 AND G16 THEN P3

Rule 4
If G6 AND G9 AND G20 AND G30 THEN P4

Rule 5
If G8 AND G10 AND G11 AND G12 AND G13 THEN P5

Rule 6
If G8 AND G14 AND G15 AND G20 THEN P6

Rule 7
If G3 AND G16 AND G17 AND G18 AND G32 THEN P7

Rule 8
If G19 AND G20 AND G33 THEN P8

Rule 9
If G12 AND G13 AND G21 AND G22 AND G28 THEN P9

Rule 10
If G1 AND G7 AND G23 AND G24 AND G25 THEN P10

Rule 11
If G23 AND G26 AND G27 THEN P11

Rule 12
If G1 AND G9 AND G12 AND G20 AND G29 AND THEN P12

Rule 13
If G1 AND G13 AND 31

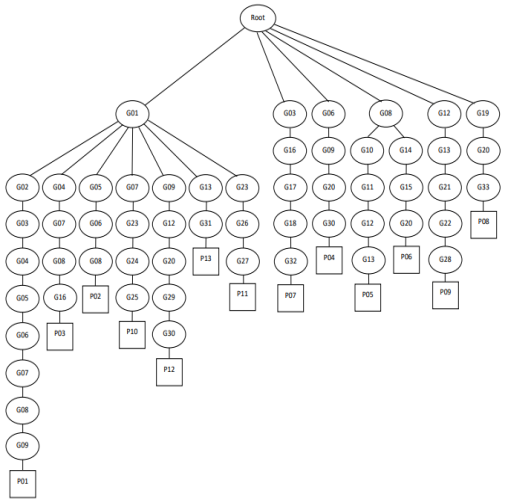

Figure 3 Decision Tree

3.2 System Implementation

1. Admin Login Page Display
This page functions as an admin login page, where the admin must log in first so that the admin can add, edit and delete existing data.

Figure 4 Login page display

2. Home Page Display
nut disease diagnosis website .

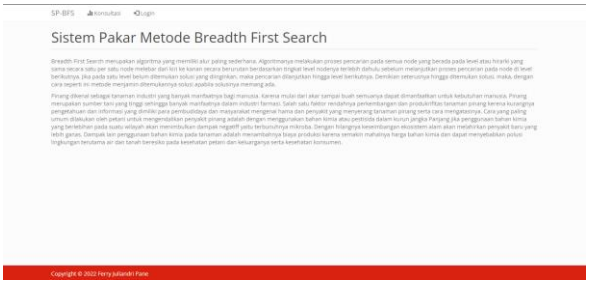

Figure 5 Initial page display

3. Disease Data Page Display
This page functions to display disease data that has been entered, and also this page functions to edit and delete disease data.

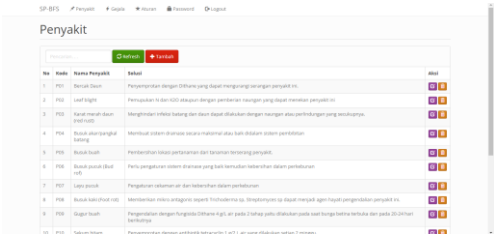

Figure 6 Display of the Disease Data Page

4. Symptom Data Page Display
This page functions to display the symptom data that has been entered, and also this page functions to edit and delete symptom data.

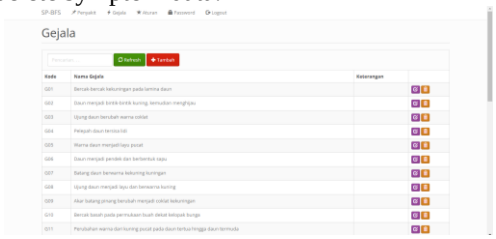

Figure 7 Display of the Symptom Data Page

5. Consultation Page View
This page functions as a way for farmers to consult on diseases of areca nut plants. Consultations are carried out by answering yes or no to the symptom questions that appear on the website.

Figure 8 Consultation page display

6. Consultation Results Page Display
This page functions to display the results of consultations from farmers who have answered the symptom questions on the consultation page.

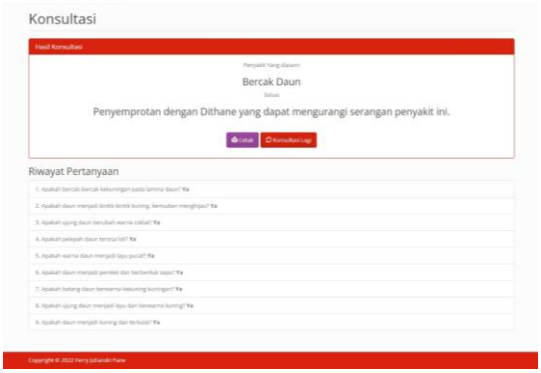

Figure 9 Display of the Consultation Results Page

4. Conclusion

Based on the results of the analysis and design of the expert system, the Breadth First Search method in diagnosing areca nut plant diseases can diagnose disease or predict disease in areca nut plants. The system designed can help the BPP Department and farmers or the public in increasing knowledge to identify areca nut diseases .

References

[1] Sari, SA, & Fitriyana, N. (2021). THE SYMBOLIC MEANING OF THE SEVEN PUMPKINS IN THE TRADITION OF THE SEVEN DAYS POST DEATH IN THE COMMUNITY OF KARANG TANDING VILLAGE, NORTH PENUKAL DISTRICT, PALI DISTRICT. Journal of Religious Studies, 5(2), 38-55. https://doi.org/10.19109/jsa.v5i2.9763

[2] Putra, FI, & Pulungan, AB (2020). Arduino Based Areca Nut Dryer. JTEV (Journal of Electrical and Vocational Engineering), 6(1), 89-97. https://doi.org/10.24036/jtev.v6i1.106444

[3] Rosmaneli, R. (2020). EXPERT SYSTEM ANALYSIS FOR DIAGNOSIS OF PESTS AND DISEASES IN Areca Palm Plants USING THE FORWARD CHAINNING METHOD. Selodang Mayang: Scientific Journal of the Regional Development Planning Agency of Indragiri Hilir Regency, 6(2), 126-126. https://doi.org/10.47521/selodangmayang.v6i2.173

[4] Satriadi, T., Susilawati, S., Badaruddin, B., Suhartono, E., & Rahmiyati, R. (2023). DEVELOPMENT OF CULTIVATION OF KELULUT HONEY BEES (Trigona sp) AT THE MIFTAHUL ULUM TABALONG Islamic Boarding School. BERNAS: Journal of Community Service, 4(1), 400-409. https://doi.org/10.31949/jb.v4i1.4050

[5] Rumetna, MS, Lina, TN, Santoso, AB, Komansilan, R., & Karay, J. (2023). Implementation of the Depth First Search Algorithm in Solving Euler Path and Circuit Problems. Komtika Journal (Computing and Informatics), 7(1), 12-21. https://doi.org/10.31603/komtika.v7i1.8672

[6] Maulana, A. (2021). Utilization of the Generate and Test Algorithm in the Case of Traveling Salesman Problem Finding the Shortest Path. Journal of Computer Systems and Informatics (JSON), 3(2), 128-133. http://dx.doi.org/10.30865/json.v3i2.3617

[7] Suryadi, S. (2014). Designing a File Search Application Using the Best First Search Method. Informatics, 2(2), 79-93. https://doi.org/10.36987/informatika.v2i2.197

[8] Handoko, MR, & Neneng, N. (2021). Expert System for Diagnosing Diseases During Pregnancy Using Web-Based Naive Bayes Method. Journal of Information Technology and Systems, 2(1), 50-58. https://doi.org/10.33365/jtsi.v2i1.739

[9] Nurhamidah, N. (2021). Cow Disease Diagnosis Expert System Using the Dhemster Shafer Method Based on Android. Journal of Informatics and Software Engineering, 2(2), 254-261. https://doi.org/10.33365/jatika.v2i2.929

[10] Darnila, E. (2015). Implementation of an Expert System in Detecting Motorcycle Engine Damage. TECHSI-Informatics Engineering Journal, 7(2). https://doi.org/10.29103/techsi.v7i2.194

[11] Yuwono, B. (2015, July). Development of an expert system on mobile devices to diagnose dental disease. In National Seminar on Informatics (SEMNASIF) (Vol. 1, No. 4).

[12] Borman, RI, Napianto, R., Nurlandari, P., & Abidin, Z. (2020). Implementation of the certainty factor in overcoming uncertainty in the expert system for diagnosing seahorse disease. Jureksi (Journal of Information Technology and Systems), 7(1), 1-8. https://doi.org/10.33330/jurteksi.v7i1.602

[13] Latumakulita, L.A. (2012). Expert System for Diagnosing Childhood Diseases Using Certainty Factor (Cf). Scientific Journal of Science, 120-126. https://doi.org/10.35799/jis.12.2.2012.705

[14] Prasetiyo, B., & Hidayah, MR (2014). Use of the Depth First Search (DFS) and Breadth First Search (BFS) Methods in the Kamen Rider Decade Game Strategy Version 0.3. Scientific Journal of Informatics, 1(2), 161-167. https://doi.org/10.15294/sji.v1i2.4022

[15] Zai, D., Budiati, H., & Berutu, SS (2016). Simulation of the Shortest Route to Tourism Locations in Nias Using the Breadth First Search and Tabu Search Methods. JOURNAL OF SCIENCE AND COMPUTERS, 1(2).

[16] Taufiq, T., & Rianti, GA (2018). Application of the Depth First Search Method in an Expert System for Diagnosing Cocoa Plant Diseases. Jutisi: Scientific Journal of Informatics Engineering and Information Systems, 7(1), 51-60. https://doi.org/10.35889/jutisi.v7i1.285

[17] Musdalipa, R., & Gusmaliza, D. (2022). Cassava Plant Diagnosis Expert System using the website-based Breadth First Search (BFS) method. Binary Scientific Journal STMIK Bina Nusantara Jaya Lubuklinggau, 4(1), 28-35. https://doi.org/10.52303/jb.v4i1.67

[18] Gustina, G., & Kuswidodo, M. R, "Disease Diagnosis in Hydroponic Green Mustard Vegetable Plants Using the Depth First Search (DFS) Algorithm", Insan Unggul Journal, 10(1), 114-132, 2022, https://doi .org/10.47926/insanunggul.2022.10.1.114-132

[19] H. Hussein, MH Radwan, HA Elsayed, and SM Abd El-Kader, "Depth-first-search-tree based D2D power allocation algorithms for V2I/V2V shared 5G network resources," Wireless Networks, vol. 27, no. 5, pp. 3179–3193, May 2021, doi: https://doi.org/10.1007/s11276-021-02649-4