

Mint Expert System Diagnosis and Treatment

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Abstract: Background: Mint is a grassy, perennial plant, belonging to the oral platoon, fast growing and spreading, its leaves are green in color, fragrant, tart, refreshing, square-shaped leg, bifurcated, erect, ranging in height from (10 - 201 cm). Home to Europe and Asia. The mint plant has many benefits, the most important of which are pain relief, treatment of gallbladder disorders, the expulsion of gases, anti-inflammatory, and relaxing nerves. While the mint plant is the ideal option for the start of gardens, it is prone to some common diseases that affect the plant's growth. **Objectives:** The main goal of this expert system is to get the appropriate diagnosis of disease and the correct treatment. **Methods:** In this paper, the design of the proposed Expert System was produced to help Farmers and those interested in agriculture in diagnosing many of the Mint diseases such as Mint rust, Verticillium wilt, Anthracnose, Powdery mildew, Black Stem Rot, Stem and stolon canker, Septoria leaf spot. The proposed expert system presents an overview of mint diseases are given, the cause of diseases outlined and the treatment of disease whenever possible is given out. CLIPS Expert System language was used for designing and implementing the proposed expert system. **Results:** The proposed Mint diseases diagnosis expert system was evaluated by Agricultural Students at AL Azhar University and some friends interested in agriculture and they were satisfied with its performance. **Conclusions:** The proposed expert system is very useful for Farmers and those interested in agriculture.

Keywords: Mint, Diagnosis, Expert System, CLIPS

1. INTRODUCTION:

Mint is a perennial herb with very fragrant, toothed leaves and tiny purple, pink, or white flowers. There are many varieties of mint—all fragrant, whether shiny or fuzzy, smooth or crinkled, bright green or variegated. However, you can always tell a member of the mint family by its square stem. Rolling it between your fingers, you'll notice a pungent scent and think of candy, sweet teas, or maybe even mint juleps.

As well as kitchen companions, mints are used as garden accents, ground covers, air fresheners, and herbal medicines. They're as beautiful as they are functional, and they're foolproof to grow, thriving in sun and shade all over North America. Since mint can be vigorous spreaders, you simply have to be careful where you plant it.

Agriculture specialists do not treat mint diseases in many places. The presence of specialists to treat plant diseases in general and mint, in particular, is rare in the greatest parts of the world. Plant diseases in general and mint, in particular, are very common these days because due to the industrial revolution, climate changes, and other impacts.

Diagnosis of mint diseases is very complex because the symptoms on their plants make them a lake, which makes them stand up to an important question of whether these symptoms are a disease or an insect or a deficiency in an element. So they need Specialists in Plant Diseases with wide experience of mint diseases. For all the aforementioned reasons, we have developed this expert system to help in diagnosing many of the mint diseases, in order to prescribe the appropriate treatment [16]. An expert system is a computer application of Artificial Intelligence (AI) [2,4,6]; which contains a knowledge base and an inference engine [3]; the main components and details are represented in figure 2.

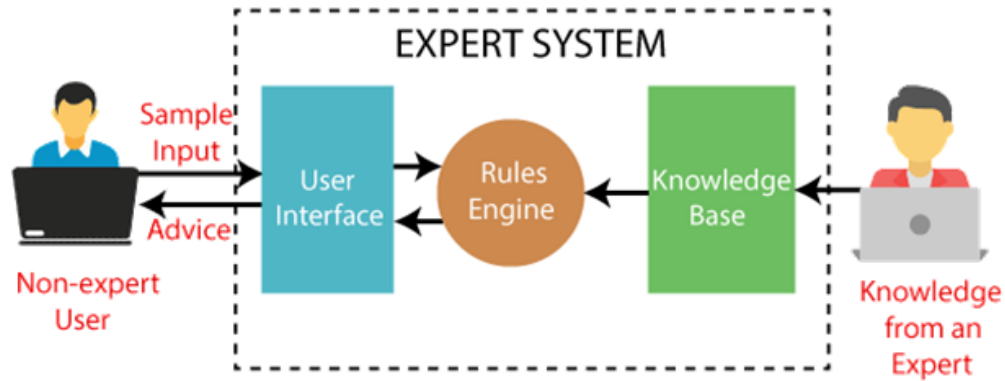


Figure 2: The figure presents the Main Components of an Expert System, Designed by the authors

The proposed Expert System for mint Diseases Diagnosis was implemented using, CLIPS Rule-Based Programming Language. It is a forward chaining reasoning expert system that can make inferences about facts of the world using rules, objects and take appropriate actions as a result. CLIPS Expert System looks like frames. It's easy for the knowledge engineer to build the Expert System and for the end users when they use the system

2. MATERIALS AND METHODS

The proposed expert system performs diagnosis for seven Mint diseases by Diagnosis of symptoms. The proposed expert system will ask the user to choose Symptoms on each screen. At the end of the dialogue session, the proposed expert system provides the diagnosis and recommendation of the disease to the user. Figure 3 shows a sample dialogue between the expert system and the user. Figure 4 shows how the users get the diagnosis and recommendation.

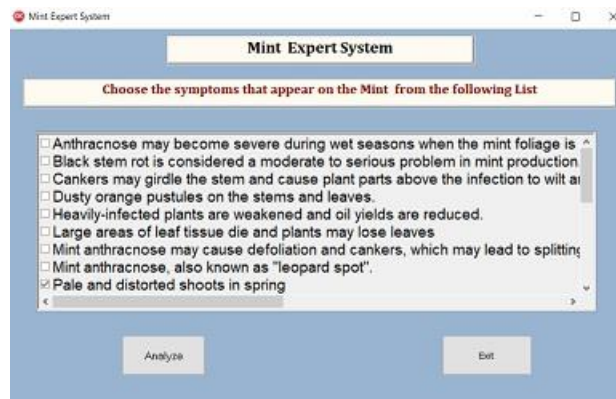


Figure 3: The figure shows symptoms of diseases the user.

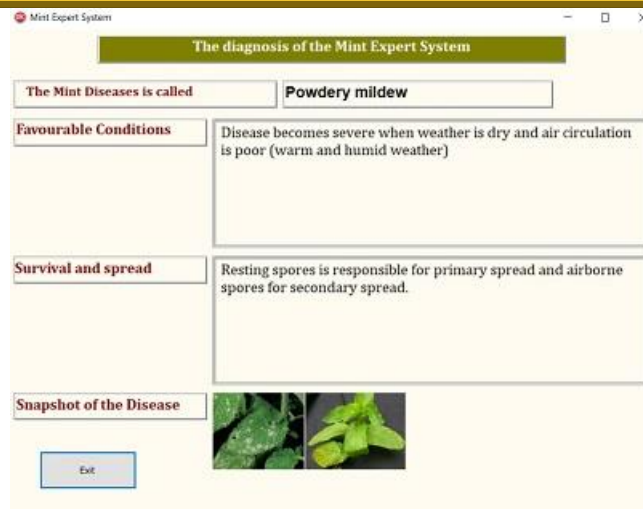


Figure 4: The figure shows diagnosis and recommendation of the expert system.

3. LITERATURE REVIEW:

3.1 Previous Studies

There are many expert systems developed in agriculture [2-25] like: papaya plant disease diagnosis, grapes diagnosis and treatment, onion rule based system for disorders diagnosis and treatment, diagnosing tobacco diseases, banana knowledge based system diagnosis and treatment, spinach expert system: diseases and symptoms, knowledge based system for apple problems using clips, diagnosing banana disorders, black pepper expert system, knowledge based system for diagnosing guava problems, an expert system for citrus diseases diagnosis, expert system for sesame diseases diagnosis, expert system for the diagnosis of mango diseases, expert system for diagnosing sugarcane diseases, expert system for the diagnosis of wheat diseases, coffee diseases, diagnosing and treating potatoes problems, safflower disease diagnosis and treatment, castor diseases and diagnosis, coconut diseases diagnosis, plant disease diagnosis, and apple trees.

There are many expert systems implemented for educations [26-28], like: guiding freshman students in selecting a major in Al-Azhar University, selecting exploratory factor analysis procedures, calculating inheritance in Islam. In general health [29-65] like: anemia expert system diagnosis, diagnosing coronavirus (covid-19), short-term abdominal pain (stomach pain) diagnosis and treatment, diagnosing breast cancer, diagnosing skin cancer, ankle problems, hip problems, hair loss diagnosis, chest pain in infants and children, diagnosis of dengue disease, high blood pressure, ankle diseases, thyroid problems, problems of teeth and gums, diagnosing cough problem, lower back pain, rickets diagnoses and treatment, neck pain diagnosis, diagnosing facial-swelling, throat problems, kidney, depression diagnosis, diabetes diagnosis, polymyalgia rheumatic, silicosis, endocrine diagnosis and treatments, arthritis diseases diagnosis, hepatitis, diagnosis of seventh nerve inflammation (bell's palsy) disease, knee problems diagnosis, and uveitis disease diagnosis. In control [69-70,] like: modeling and controlling smart traffic light system. In maintenance [66-68], like: photo copier maintenance, desktop pc troubleshooting, and diagnosing wireless connection problems.

3.2 Comments about previous studies

Although, there are many expert systems in agriculture field, there are no expert system for diagnosing mint diseases and treatment. That is why we are proposing expert system for diagnosing and treating mint problems.

4. KNOWLEDGE REPRESENTATION:

The main sources of knowledge for this expert system are farmers and specialized websites for Plant Diseases. The captured knowledge has been converted into CLIPS Rule-Based Programming Language (Facts and Rules) [1]. Currently, the expert system has 22 rules, which cover seven mint diseases:

Mint rust is a common fungal disease of garden mint, but also affects marjoram and savory The fungus causes dusty orange, yellow and black spots on leaves, and distortion of shoots.



Figure 5: The figure shows Mint rust disease.

The cause may be for this disease is the presence of these four conditions:

- Pale and distorted shoots in spring
- Dusty orange pustules on the stems and leaves.
- Pustule may change to dusty yellow or black in color in later stage
- Large areas of leaf tissue die and plants may lose leaves

Verticillium wilt: wilt is a serious disease of peppermint in the Pacific Northwest. Once the fungus is established in a field, oil yield may be reduced, stands may decline, and the ability of mint plants to compete with weeds may be reduced. Infected plants eventually die.



Figure 6: The figure shows Verticillium wilt disease.

The cause may be for this disease is the presence of these four conditions:

- Symptoms first appear in the foliage at the top of the plant.
- Symptomatic upper leaves are sickle-shaped and initially chlorotic or red, soon becoming necrotic.
- Premature defoliation and death of the plant can result.
- Vascular discoloration in stems and roots may be observed and diseased plants are often stunted.

Mint anthracnose, also known as "leopard spot". The fungus causes small, sunken brown spots to appear on the lower leaves and stems. These spots enlarge to form oval lesions with light gray centers and reddish-brown borders and may unite.



Figure 7: The figure shows anthracnose disease.

The cause may be for this disease is the presence of these four conditions:

- Mint anthracnose, also known as "leopard spot".
- The fungus causes small, sunken brown spots to appear on the lower leaves and stems. These spots enlarge to form oval lesions with light gray centers and reddish-brown borders, and may unite.
- Mint anthracnose may cause defoliation and cankers, which may lead to splitting of the stem.

- Heavily-infected plants are weakened and oil yields are reduced.
- Anthracnose may become severe during wet seasons when the mint foliage is wet for long periods.

Powdery mildew: Powdery mildew is often severe on mint grown in the greenhouse due to humid, shady conditions. Mint infected with powdery mildew is sensitive to winter injury. Powdery mildew appears on mint leaves, stems, and petioles as a powdery, white to gray coating of fungal mycelium and spores.



Figure 8: The figure shows Powdery mildew disease.

The cause may be for this disease is the presence of these four conditions:

- Powdery white patches are developed on the upper and lower surfaces of the leaves and stems.
- Under favorable conditions, the disease causes severe losses. It also reduces the oil.

Black Stem Rot: Black stem rot is considered a moderate to serious problem in mint production. The fungus is most active during periods of cool and wet weather. Symptoms of infection include dark brown or black cankers on stems. Cankers may girdle the stem and cause plant parts above the infection to wilt and die.



Figure 9: The figure shows Black Stem Rot disease.

The cause may be for this disease is the presence of these four conditions:

- Black stem rot is considered a moderate to serious problem in mint production.
- The fungus is most active during periods of cool and wet weather.
- Symptoms of infection include dark brown or black cankers on stems.
- Cankers may girdle the stem and cause plant parts above the infection to wilt and die.

Stem and stolon canker: Stem and stolon canker are **caused by Rhizoctonia solani**. Symptoms Roots, runners, and rhizomes have brown or black progressively rotting areas. Stands may be greatly reduced, frequently in spots. Plow in fall.



Figure 10: The figure shows Stem and stolon canker disease.

The cause may be for this disease is the presence of these four conditions:

- Roots and stolon have brown or black progressively rotting areas. Plant stand may be greatly reduced.

Septoria leaf spot: Septoria leaf spot is a foliar fungal disease of Septoria species. Moderately warm temperatures and prolonged humid conditions favor the fungal problem. The fungus *Septoria lycopersici* is to blame for the black spotting on most mint plants' foliage.



Figure 11: The figure shows Septoria leaf spot disease.

The cause may be for this disease is the presence of these four conditions:

- Septoria leaf spots are dark brown/black, up to 3mm (1/8in) in diameter and angular in shape (being constricted between leaf veins).
- Spores are sometimes visible within leaf spots on the underside of the leaf.

5. LIMITATIONS:

The currently proposed expert system is specialized in the diagnosis of only the following seven Mint diseases: Mint rust, Verticillium wilt, Anthracnose, Powdery mildew, Black Stem Rot, Stem and stolon canker, Septoria leaf spot.

6. SYSTEM EVALUATION:

As a preliminary evolution, some students at the College of Agriculture and some interested in agriculture tested this proposed Expert System and they were satisfied with its performance, efficiency, user interface, and ease of use.

7. CONCLUSION:

In this paper, a proposed expert system was presented for helping Farmers and those interested in agriculture. Mint may suffer from seven different diseases they have. Farmers and those interested in agriculture can get the diagnosis faster and more accurately than the traditional diagnosis. This expert system does not need intensive training to be used; it is easy to use and has a user-friendly interface. It was developed using CLIPS Rule-Based Programming Language.

8. FUTURE WORK:

This expert system is considered to be a base for future ones; more mint diseases are planned to be added to make it more accessible to users from anywhere at any time.

References

1. <https://vikaspedia.in/agriculture/crop-production/integrated-pest-management/ipm-for-fruit-crops/ipm-strategies-for-strawberry/strawberry-diseases>.
2. Abu-Saqer, M. M., et al. (2019). "Developing an Expert System for Papaya Plant Disease Diagnosis." *International Journal of Academic Engineering Research (IJAER)* 3(4): 14-21.
3. Alajrami, M. A., et al. (2018). "Onion Rule Based System for Disorders Diagnosis and Treatment." *International Journal of Academic Pedagogical Research (IJAPR)* 2(8): 1-9.
4. Alajrami, M. A., et al. (2019). "Grapes Expert System Diagnosis and Treatment." *International Journal of Academic Engineering Research (IJAER)* 3(5): 38-46.
5. Aldaour, A. F., et al. (2019). "An Expert System for Diagnosing Tobacco Diseases Using CLIPS." *International Journal of Academic Engineering Research (IJAER)* 3(3): 12-18.
6. Almadhoun, H. R., et al. (2018). "Banana Knowledge Based System Diagnosis and Treatment." *International Journal of Academic Pedagogical Research (IJAPR)* 2(7): 1-11.
7. Al-Qumboz, M. N. A., et al. (2019). "Spinach Expert System: Diseases and Symptoms." *International Journal of Academic Information Systems Research (IJAISR)* 3(3): 16-22.
8. Al-Shawwa, M., et al. (2019). "Knowledge Based System for Apple Problems Using CLIPS." *International Journal of Academic Engineering Research (IJAER)* 3(3): 1-11.
9. AlZamily, J. Y., et al. (2018). "A Cognitive System for Diagnosing Musa Acuminata Disorders." *International Journal of Academic Information Systems Research (IJAISR)* 2(8): 1-8.
10. Barhoom, A. M., et al. (2018). "Black Pepper Expert System." *International Journal of Academic Information Systems Research (IJAISR)* 2(8): 9-16.
11. Dheir, I., et al. (2019). "Knowledge Based System for Diagnosing Guava Problems." *International Journal of Academic Information Systems Research (IJAISR)* 3(3): 9-15.
12. El Kahlout, M. I., et al. (2019). "An Expert System for Citrus Diseases Diagnosis." *International Journal of Academic Engineering Research (IJAER)* 3(4): 1-7.
13. El-Mashharawi, H. Q., et al. (2019). "An Expert System for Sesame Diseases Diagnosis Using CLIPS." *International Journal of Academic Engineering Research (IJAER)* 3(4): 22-29.
14. Elqassas, R., et al. (2018). "Expert System for the Diagnosis of Mango Diseases." *International Journal of Academic Engineering Research (IJAER)* 2(8): 10-18.
15. Elsharif, A. A., et al. (2019). "An Expert System for Diagnosing Sugarcane Diseases." *International Journal of Academic Engineering Research (IJAER)* 3(3): 19-27.
16. Mansour, A. I., et al. (2019). "Expert System for the Diagnosis of Wheat Diseases." *International Journal of Academic Information Systems Research (IJAISR)* 3(4): 19-26.
17. Mettleq, A. S. A., et al. (2019). "A Rule Based System for the Diagnosis of Coffee Diseases." *International Journal of Academic Information Systems Research (IJAISR)* 3(3): 1-8.
18. Musleh, M. M., et al. (2018). "Rule Based System for Diagnosing and Treating Potatoes Problems." *International Journal of Academic Engineering Research (IJAER)* 2(8): 1-9.
19. Salman, F., et al. (2019). "Rule based System for Safflower Disease Diagnosis and Treatment." *International Journal of Academic Engineering Research (IJAER)* 3(8): 1-10.
20. Salman, F. M., et al. (2019). "Expert System for Castor Diseases and Diagnosis." *International Journal of Engineering and Information Systems (IJEIS)* 3(3): 1-10.
21. Alshawwa, I. A., et al. (2019). "An Expert System for Coconut Diseases Diagnosis." *International Journal of Academic Engineering Research (IJAER)* 3(4): 8-13.
22. Kashkash, K. A., et al. (2010). "Developing an expert system for plant disease diagnosis." *Journal of Artificial Intelligence; Scialert* 3(4): 269-276.
23. Khalil, A. J., et al. (2019). "Apple Trees Knowledge Based System." *International Journal of Academic Engineering Research (IJAER)* 3(9): 1-7.
24. Akkila, A. N., et al. (2016). "Proposed Expert System for Calculating Inheritance in Islam." *World Wide Journal of Multidisciplinary Research and Development* 2(9): 38-48.
25. Azaab, S., et al. (2000). "A proposed expert system for selecting exploratory factor analysis procedures." *Journal of the College of Education* 4(2): 9-26.
26. Baraka, M. H., et al. (2008). "A Proposed Expert System for Guiding Freshman Students in Selecting a Major in Al-Azhar University, Gaza." *Journal of Theoretical & Applied Information Technology* 4(9).
27. Aldaour, A. F., et al. (2019). "Anemia Expert System Diagnosis Using S15 Object." *International Journal of Academic Information Systems Research (IJAISR)* 3(5): 9-17.
28. Almadhoun, H. R., et al. (2020). "An Expert System for Diagnosing Coronavirus (COVID-19) Using SL5." *International Journal of Academic Engineering Research (IJAER)* 4(4): 1-9.
29. Al-Masawabe, M. M., et al. (2021). "Expert System for Short-term Abdominal Pain (Stomach Pain) Diagnosis and Treatment." *International Journal of Academic Information Systems Research (IJAISR)* 5(5): 37-56.
30. Almurshidi, S. H., et al. (2018). Expert System For Diagnosing Breast Cancer, Al-Azhar University, Gaza, Palestine.
31. Al-Shawwa, M. O., et al. (2019). "A Proposed Expert System for Diagnosing Skin Cancer Using SL5 Object." *International Journal of Academic Information Systems Research (IJAISR)* 3(4): 1-9.
32. Elhabib, B. Y., et al. (2021). "An Expert System for Ankle Problems." *International Journal of Engineering and Information Systems (IJEIS)* 5(4).
33. Elhabib, B. Y., et al. (2021). "Expert System for Hib Problems." *International Journal of Academic Information Systems Research (IJAISR)* 5(5):5-15.
34. Hamada, M. H. M., et al. (2021). "Hair Loss Diagnosis Expert System and Treatment Using CLIPS." *International Journal of Academic Engineering Research (IJAER)* 5(5): 37-42.
35. Khella, R., et al. (2017). "Rule Based System for Chest Pain in Infants and Children." *International Journal of Engineering and Information Systems (IJEIS)* 1(4): 138-148.
36. Mansour, A. I., et al. (2019). "Knowledge Based System for the Diagnosis of Dengue Disease." *International Journal of Academic Health and Medical Research (IJAHRM)* 3(4): 12-19.
37. Mansour, A. I. and S. S., et al. (2021). "Expert system for the diagnosis of high blood pressure diseases."
38. Qwaider, S. R., et al. (2017). "Expert System for Diagnosing Ankle Diseases." *International Journal of Engineering and Information Systems (IJEIS)* 1(4): 89-101.
39. Salman, F. M., et al. (2019). "Thyroid Knowledge Based System." *International Journal of Academic Engineering Research (IJAER)* 3(5): 11-20.
40. Salman, F. M., et al. (2020). "Expert System for COVID-19 Diagnosis." *International Journal of Academic Information Systems Research (IJAISR)* 4(3): 1-13.
41. Abu Ghali, M. J., et al. (2017). "Expert System for Problems of Teeth and Gums." *International Journal of Engineering and Information Systems (IJEIS)* 1(4): 198-206.
42. Abu-Jamie, T. N., et al. (2021). "Diagnosing Cough Problem Expert System Using CLIPS." *International Journal of Academic Information Systems Research (IJAISR)* 5(5): 79-90.
43. Ahmed, A., et al. (2019). "Knowledge-Based Systems Survey." *International Journal of Academic Engineering Research (IJAER)* 3(7): 1-22.
44. Aish, M. A., et al. (2021). "Lower Back Pain Expert System Using CLIPS." *International Journal of Academic Information Systems Research (IJAISR)* 5(5): 57-67.
45. Al Rekhawi, H. A., et al. (2017). "Rickets Expert System Diagnoses and Treatment." *International Journal of Engineering and Information Systems (IJEIS)* 1(4): 149-159.
46. Alfarr, A. H., et al. (2021). "An Expert System for Neck Pain Diagnosis." *International Journal of Academic Information Systems Research (IJAISR)* 5(7): 1-8.
47. Alkahlout, M. A., et al. (2021). "Expert System Diagnosing Facial-Swelling Using CLIPS."
48. Alkahlout, M. A., et al. (2021). "Expert System for Throat Problems Using SL5 Object." *International Journal of Academic Information Systems Research (IJAISR)* 5(5): 68-78.
49. Alkahlout, M. A., et al. (2021). "Knowledge Based System for Diagnosing Throat Problem CLIPS and Delphi languages." *International Journal of Academic Engineering Research (IJAER)* 5(6): 7-12.
50. Al-Qumboz, M. N. A., et al. (2019). "Kidney Expert System Diseases and Symptoms." *International Journal of Academic Engineering Research (IJAER)* 3(5): 1-10.
51. Alsaqqa, A. H., et al. (2021). "Knowledge Based for Tooth Problems." *International Journal of Academic Information Systems Research (IJAISR)* 5(5).
52. Alshawwa, I. A., et al. (2019). "An Expert System for Depression Diagnosis." *International Journal of Academic Health and Medical Research (IJAHRM)* 3(4): 20-27.
53. Dheir, I. M., et al. (2019). "Knowledge Based System for Diabetes Diagnosis Using SL5 Object." *International Journal of Academic Pedagogical Research (IJAPR)* 3(4): 1-10.
54. El Agha, M., et al. (2017). "Polymyalgia Rheumatic Expert System." *International Journal of Engineering and Information Systems (IJEIS)* 1(4): 125-137.
55. El Kahlout, M. I., et al. (2019). "Silicosis Expert System Diagnosis and Treatment." *International Journal of Academic Information Systems Research (IJAISR)* 3(5): 1-8.
56. El-Hissi, H., et al. (2010). "An expert system for endocrine diagnosis and treatments using JESS." *Journal of Artificial Intelligence; Scialert* 3(4): 239-251.
57. El-Mashharawi, H. Q., et al. (2019). "An Expert System for Arthritis Diseases Diagnosis Using SL5 Object." *International Journal of Academic Health and Medical Research (IJAHRM)* 3(4): 28-35.
58. Elsharif, A. A., et al. (2019). "Hepatitis Expert System Diagnosis Using S15 Object." *International Journal of Academic Information Systems Research (IJAISR)* 3(4): 10-18.
59. Mansour, A. I., et al. (2021). "An Expert System for Diagnosing Cough Using SL5 Object." *International Journal of Academic Engineering Research (IJAER)* 5(6): 13-27.
60. Mettleq, A. S. A., et al. (2019). "Expert System for the Diagnosis of Seventh Nerve Inflammation (Bell's palsy) Disease." *International Journal of Academic Information Systems Research (IJAISR)* 3(4): 27-35.
61. Mrouf, A., et al. (2017). "Knowledge Based System for Long-term Abdominal Pain (Stomach Pain) Diagnosis and Treatment." *International Journal of Engineering and Information Systems (IJEIS)* 1(4): 71-88.
62. Nabahin, A., et al. (2017). "Expert System for Hair Loss Diagnosis and Treatment." *International Journal of Engineering and Information Systems (IJEIS)* 1(4): 160-169.
63. Samhan, L. F., et al. (2021). "Expert System for Knee Problems Diagnosis." *International Journal of Academic Information Systems Research (IJAISR)* 5(4):59-66.
64. AbuEl-Reesh, J. Y., et al. (2017). "A Knowledge Based System for Diagnosing Shortness of Breath in Infants and Children." *International Journal of Engineering and Information Systems (IJEIS)* 1(4): 102-115.
65. Abu-Saqer, M. M., et al. (2019). "Knowledge Based System for Uveitis Disease Diagnosis." *International Journal of Academic Information Systems Research (IJAISR)* 3(5): 18-25.
66. Bakeer, H., et al. (2017). "Photo Copier Maintenance Expert System V. 01 Using SL5 Object Language." *International Journal of Engineering and Information Systems (IJEIS)* 1(4): 116-124.
67. Dahouk, A. W., et al. (2018). "A Proposed Knowledge Based System for Desktop PC Troubleshooting." *International Journal of Academic Pedagogical Research (IJAPR)* 2(6): 1-8.
68. Alamawi, W. W., et al. (2016). "Rule Based System for Diagnosing Wireless Connection Problems Using SL5 Object." *International Journal of Information Technology and Electrical Engineering* 5(6): 26-33.
69. Albatish, I. M., et al. (2019). Modeling and controlling smart traffic light system using a rule based system. 2019 International Conference on Promising Electronic Technologies (ICPET), IEEE.
70. Masri, N., et al. (2019). "Survey of Rule-Based Systems." *International Journal of Academic Information Systems Research (IJAISR)* 3(7): 1-23.