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A Cognitive System for Diagnosing Musa Acuminata Disorders

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Abstract: Background: *Plant production provides human and animal life with different requirements. The concern of workers in agriculture in general and those interested in plant diseases, in particular, has been focused on protection from all that is expected to have problems of production. As environmental conditions play a critical role in the treatment of diseases, the plant is prepared and rendered more susceptible to production, which is exposed and may result in the loss of the entire crop.* ***Objectives:*** *The main goal of this expert system is to get the appropriate diagnosis of musa acuminata disease and the correct treatment.* ***Methods:*** *In this paper the design of the proposed Expert System which was produced to help farmers, people interested in agriculture and agricultural engineers in diagnosing many of the musa acuminata diseases such as: Panama wilt, Mycosphaerella leaf spot, yellow sigatoka, black sigatoka, Anthracnose, Moko disease/bacterial wilt, Tip over or bacterial soft rot, Bunchy top/curly top, Musa acuminata bract mosaic virus (BBMV), Musa acuminata Streak disease (BSV), Infectious chlorosis (CMV). The proposed expert system presents an overview about musa acuminata diseases are given, the cause of diseases are outlined and the treatment of disease whenever possible is given out. CLIPS with Delphi language was used for designing and implementing the proposed expert system.* ***Results:*** *The proposed musa acuminata diseases diagnosis expert system was evaluated by farmers, agricultural experts and Agriculture teachers and they were satisfied with its performance.* ***Conclusions:*** *The Proposed expert system is very useful for Farmers, and those interested in agriculture with musa acuminata disease and recent graduate students.*

Keywords: cognative system, musa acuminata, disorder

1. INTRODUCTION

A musa acuminata is an edible fruit produced by several kinds of large herbaceous flowering plants in the genus Musa. In some countries, musa acuminatas used for cooking may be called plantains, distinguishing them from dessert musa acuminatas. The fruit is variable in size, color, and firmness, but is usually elongated and curved, with soft flesh rich in starch covered with a rind, which may be green, yellow, red, purple, or brown when ripe. The fruits grow in clusters hanging from the top of the plant [1].

Figure 1: The figure shows Musa acuminata [1]

Although musa acuminata can be very easy to grow in different places, there are many diseases, pests and other issues which can affect musa acuminata growth. Identifying these problems is the first step to solving them, and catching the problem early can make the disease treatments. So we have developed this expert system to help Agricultural engineer and farmers in diagnosing many of the musa acuminata diseases, in order to prescribe the appropriate treatment.

An expert system is a program designed to simulate the intelligence of an expert in a particular field. It is mainly developed using artificial intelligence concepts, tools and technologies. An expert system is typically designed to provide capabilities similar to those of a human expert when performing a task. Moreover, it can be used to drive vehicles, provide financial forecasts or do things that human experts do (as shown in figure 2).

An expert system usually has two core components [2]:

- Knowledge base -- This component consists of data, facts and rules for a certain topic, industry or skill, usually equivalent to that of a human expert.
- Interference engine -- This component uses the facts and rules in the knowledge base to find and learn new knowledge or patterns.

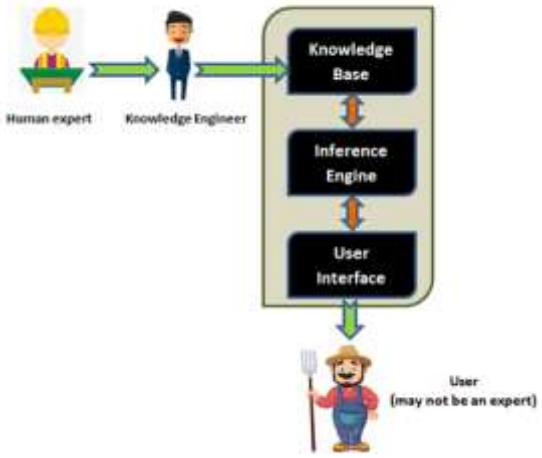

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Figure 2: The figure presents the Main Components of an Expert System [2].

The proposed Expert System for Musa Acuminata Diseases Diagnosis was implemented using, CLIPS language with Delphi. It is a forward chinning reasoning expert system that can make inferences about facts of the world using rules, objects and take appropriate actions as a result. CLIPS Object executes any 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 eleven musa acuminata diseases o by Show symptoms. The proposed expert system will ask the user to choose the correct Symptoms of potato disease in each screen. At the end of the dialogue session, the proposed expert system provides the diagnosis and recommendation of the disease to the user.

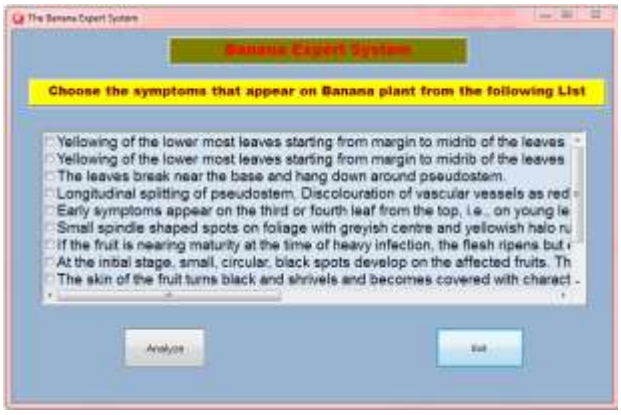

Figure 3 shows a sample dialogue between the expert system and the user.

Figure 4 shows how the users get the diagnosis and recommendation

3. LITERATURE REVIEW

There is a lot of Expert System that were designed to diagnose plant Diseases. But there is no specialized expert system for diagnosis of musa acuminata diseases available free and use CLIPS language linked with Delphi as the user interface. This expert system is easily use it by farmers and people concerned. This is due to the coordinated application interface. Some of these Expert Systems are specialized in one specific disease and others in five diseases; but the current proposed expert system is specialized in the diagnosis of nine musa acuminata diseases.

4. KNOWLEDGE REPRESENTATION

The main source of the knowledge for this expert system is Agricultural expert and specialized websites for musa acuminata diseases. The captured knowledge has been converted into CLIPS syntax. Currently the expert system has rules which cover nine musa acuminata diseases.

4.1 Panama wilt

Disease symptoms

- Yellowing of the lower most leaves starting from margin to midrib of the leaves
- Yellowing extends upwards and finally heart leaf alone remains green for some time and it is also affected.
- The leaves break near the base and hang down around pseudostem.

Longitudinal splitting of pseudostem. Discolouration of vascular vessels as red or brown streaks(as shown in Figure 5).

- **Survival and spread**
- The pathogen spreads through infected rhizomes.

Favourable conditions

- Continuous cultivation in the infested field or monocroping results in buildup of inoculum.

Figure 5: The figure shows the Symptoms of the disease Panama wilt

4.2 Mycosphaerella leaf spot, yellow sigatoka, black sigatoka

Disease symptoms

- Early symptoms appear on the third or fourth leaf from the top, i.e., on young leaves.
- Small spindle shaped spots on foliage with greyish centre and yellowish halo running parallel to veins.

If the fruit is nearing maturity at the time of heavy infection, the flesh ripens but evenly and individual musa acuminatas appear undersized and their flesh develops a buff pinkish colour, and store poorly(as shown in Figure 6).

Survival and spread

- The conidia of the fungus are carried by wind, rain water and old dried infected leaves and they help to spread the disease.

Figure 6: The figure shows the Symptoms of the disease Mycosphaerella leaf spot

4.3 Anthracnose

Disease symptoms

- At the initial stage, small, circular, black spots develop on the affected fruits. Then these spots enlarge in size, turn to brown colour
- The skin of the fruit turns black and shrivels and becomes covered with characteristic pink acervuli. Finally the whole finger is affected. Later the disease spreads and affects the whole bunch.
- The disease results in premature ripening and shriveling of the fruits which are covered with pink spore masses.
- Occurrence if black lesions on the pedicel causes withering of the pedicel and dropping of the fingers from the hands.

Sometimes the main stalk of the bunch may become diseased. Infected fruits become black and rotten (as shown in Figure 7).

Survival and spread

- The spread of the disease is by air-borne conidia and numerous insects which frequently visit musa acuminata flowers also spread the disease.

Favourable conditions

- The disease is favoured by high atmospheric temperature and humidity, wounds and brusies caused in the fruit and susceptibility of the variety.

Figure 7: The figure shows the Symptoms of the Anthracnose

4.4 Moko disease/bacterial wilt

Disease symptoms

- Leaves become yellow and progress upwards. The petiole breaks and leaves hang.
- When it is cut open discolouration in vascular region with pale yellow to dark brown colour.
- The discolouration is in the central portion of the corm.
- Internal rot of fruits with dark brown discoloration.
- When the pseudostem is cut transversely bacterial ooze can be seen in Figure 8.

Survival and spread

- The bacterium survives in infected plant material, vegetative propagative organs, wild host plants, and soil.

Favourable conditions

- High temperatures and high soil moisture generally favors disease.

Figure 8: The figure shows the Symptoms of the Moko disease/bacterial wilt

4.5 Tip over or bacterial soft rot

Disease symptoms

- This disease is more pronounced on young suckers leading to rotting and emitting of foul odour.
- Roting of collar region is a commonest symptom followed by epinasty of leaves, which dry out suddenly.
- If affected plants are pulled out it comes out from the collar region leaving the corm with their roots in the soil.
- In early stage of infection dark brown or yellow water soaked areas are more in the cortex area When affected plants are cut open at collar region yellowish to reddish ooze is seen Figure 9.

Survival and spread

- Bacteria survive in crop debris and infect by water splash through damaged tissues.
- Worse in hot wet weather. The bacteria spread in contaminated water.

Favourable conditions

- Higher temperatures and high humidity are ideal growing conditions for the bacteria.

Figure 8: The figure shows the Symptoms of the Tip over or bacterial soft rot

4.6 Bunchy top/curly top

Disease symptoms

- Prominent dark green streaks on the petioles and midrib along the leaf veins.
- Marginal chlorosis and curling of leaves
- Petioles fail to elongate
- Leaves are reduced in size, chlorotic, stand upright and become brittle and are crowded at the top (Bunchy top) and shoe dark green streaks with 'J hook' shape near the midrib.
- Flowers display mottled and streaked discolouration

Plants show marked stunting (as shown in Figure 9).

Survival and spread

- Vector: musa acuminata aphid, Pentalonia nigronervosa
- The disease can be spread by infected plant debris, plant wounds and injuries.

Favourable conditions

- Hot and damp weather with plenty of rainfall trigger the disease to occur.

Figure 9: The figure shows the Symptoms of the Bunchy top/curly top

4.7 Musa acuminata bract mosaic virus (BBMV)

Disease symptoms

- The disease is characterized by the presence of spindle shaped pinkish to reddish streaks on pseudostem, midrib and peduncle
- Typical mosaic and spindle shaped mild mosaic streaks on bracts, peduncle and fingers also observed
- Suckers exhibit unusual reddish brown streaks at emergence and separation of leaf sheath from central axis

Clustering of leaves at crown with a travelers palm appearance, elongated peduncle and half filled hands are its characteristic symptom (as shown in Figure 10).

Survival and spread

- The disease is caused by a virus belonging to potyvirus group. The virions are flexuous filamentous
- The virus is transmitted through aphid vectors such as Aphis gosypii, Pentolonia nigronervosa and Rhopalosiphum maidis. In field the disease spread mainly through suckers.

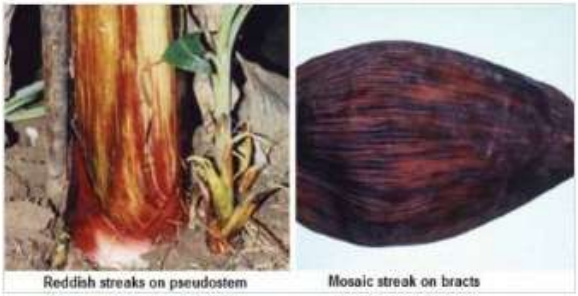

Figure 10: The figure shows the Symptoms of the BBMV

4.8 Musa acuminata streak disease (BSV)

Disease symptoms

A prominent symptom exhibited by BSV is yellow streaking of the leaves, which becomes progressively necrotic producing a black streaked appearance in older leaves (as shown in Figure 11).

Survival and spread

- The virus is transmitted mostly through infected planting materials, though mealy bugs (Planococcus citri) and more probably Saccharicoccus sacchari are also believed to transmit it. Shoot tip culture does not eliminate it from vegetatively propagated materials.

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Figure 11: The figure shows the Symptoms of the BSV

4.9 Infectious chlorosis (CMV)

Disease symptoms

- The disease manifests itself in all stages of crop growth.
- Due to repeated use of suckers from infected plants the disease spreads and resulting in the gradual decrease in yield and quality.
- The disease is known to occur in all musa acuminata-growing states.
- Light yellow streaks run parallel to leaf veins giving the leaf a striped appearance.

The streaks run usually from mid rib to edge of the blade(as shown in Figure 12).

Survival and spread

- Virus is disseminated by suckers and Aphis gossypi.

Figure 12: The figure shows the Symptoms of the CMV

5. LIMITATIONS

The current proposed expert system is specialized in the diagnosis only the following nine musa acuminata diseases: Panama wilt, Mycosphaerella leaf spot, yellow sigatoka, black sigatoka, Anthracnose, Moko disease/bacterial wilt, Tip over or bacterial soft rot, Bunchy top/curly top, Musa acuminata bract mosaic virus (BBMV), Musa acuminata streak disease (BSV), Infectious chlorosis (CMV).

6. SYSTEM EVALUATION

As a preliminary evolution, many agricultural engineers, agricultural teachers and agriculture students 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 as well as those interested in agriculture in musa acuminata disease with nine different possible potatoes diseases. Farmers as well as those interested in agriculture diseases can get the diagnosis faster and more accurate than the traditional diagnosis. This expert system does not need intensive training to be used; it is easy to use and has user friendly interface. It was developed using CLIPS with Delphi language.

8. FUTURE WORK

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

9. EXPERT SYSTEM SOURCE CODE

```
(defrule disease1
(musa acuminata-symptom 1 yes)
(musa acuminata-symptom 2 yes)
(musa acuminata-symptom 3 yes)
(musa acuminata-symptom 4 yes)
(not (musa acuminata disease identified))
=>
(assert (musa acuminata disease identified))
(printout fdatao "1"  crlf )
)


(defrule disease2
(musa acuminata-symptom 5 yes)
(musa acuminata-symptom 6 yes)
(musa acuminata-symptom 7 yes)
(not (musa acuminata disease identified))
=>
(assert (musa acuminata disease identified))
(printout fdatao "2"  crlf )
)
(defrule disease3
(musa acuminata-symptom 8 yes)
(musa acuminata-symptom 9 yes)
(musa acuminata-symptom 10 yes)
(musa acuminata-symptom 11 yes)
(musa acuminata-symptom 12 yes)
(not (musa acuminata disease identified))
=>
(assert (musa acuminata disease identified))
(printout fdatao "3"  crlf )
)
```

```
(defrule disease4
(musa acuminata-symptom 13 yes)
(musa acuminata-symptom 14 yes)
(musa acuminata-symptom 15 yes)
(musa acuminata-symptom 16 yes)
(musa acuminata-symptom 17 yes)
(not (musa acuminata disease identified))
=>
(assert (musa acuminata disease identified))
(printout fdatao "4"  crlf )
)
(musa acuminata-symptom 18 yes)
(musa acuminata-symptom 19 yes)
(musa acuminata-symptom 20 yes)
(musa acuminata-symptom 21 yes)
(not (musa acuminata disease identified))
=>
(assert (musa acuminata disease identified))
(printout fdatao "5"  crlf )
)
(defrule disease6
(musa acuminata-symptom 22 yes)
(musa acuminata-symptom 23 yes)
(musa acuminata-symptom 24 yes)
(musa acuminata-symptom 25 yes)
(musa acuminata-symptom 26 yes)
(musa acuminata-symptom 27 yes)
(not (musa acuminata disease identified))
=>
(assert (musa acuminata disease identified))
(printout fdatao "6"  crlf )
)
(defrule disease7
(musa acuminata-symptom 28 yes)
(musa acuminata-symptom 29 yes)
(musa acuminata-symptom 30 yes)
(musa acuminata-symptom 31 yes)
(not (musa acuminata disease identified))
=>
(assert (musa acuminata disease identified))
(printout fdatao "7"  crlf )
)

(defrule disease8
(musa acuminata-symptom 32 yes)
(not (musa acuminata disease identified))
=>
(assert (musa acuminata disease identified))
(printout fdatao "8"  crlf )
)
(defrule disease9
(musa acuminata-symptom 33 yes)
(musa acuminata-symptom 34 yes)
(musa acuminata-symptom 35 yes)
(musa acuminata-symptom 36 yes)
(musa acuminata-symptom 37 yes)
(not (musa acuminata disease identified))
=>
(assert (musa acuminata disease identified))
(printout fdatao "9"  crlf )
)

(defrule endline
(musa acuminata disease identified)
=>
  (close fdatao)
)
(defrule readdata
  (declare (salience 1000))
  (initial-fact)
  ?fx <- (initial-fact)
=>
  (retract ?fx)
  (open "data.txt" fdata "r")
  (open "result.txt" fdatao "w")
  (bind ?symptom1 (read fdata))
  (bind ?symptom2 (read fdata))
  (bind ?symptom3 (read fdata))
  (bind ?symptom4 (read fdata))
  (bind ?symptom5 (read fdata))
  (bind ?symptom6 (read fdata))
  (bind ?symptom7 (read fdata))
  (bind ?symptom8 (read fdata))
  (assert
    (musa acuminata-symptom ?symptom1 yes)
    (musa acuminata-symptom ?symptom2 yes)
    (musa acuminata-symptom ?symptom3 yes)
    (musa acuminata-symptom ?symptom4 yes)
    (musa acuminata-symptom ?symptom5 yes)
    (musa acuminata-symptom ?symptom6 yes)
    (musa acuminata-symptom ?symptom7 yes)
    )
   (close fdata)
)
```

REFERENCES

1. http://vikaspedia.in/agriculture/crop-production/integrated-pest-managment/ipm-for-fruit-crops/ipm-strategies-for-musa acuminata/diseases-and-symptoms.
2. https://www.farmingindia.in/musa acuminata-cultivation
3. Abu Naser, S. S., & ALmursheidi, S. H. (2016). A Knowledge Based System for Neck Pain Diagnosis. World Wide Journal of Multidisciplinary Research and Development (WWJMRD), 2(4), 12-18.
4. Abu Ghali, M. J., Mukhaimer, M. N., Abu Yousef, M. K., & Abu Naser, S. S. (2017). Expert System for Problems of Teeth and Gums. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 198-206.

5. Abu Naser, S., & Akkila, A. N. (2008). A Proposed Expert System for Skin Diseases Diagnosis. INSInet Publication. Journal of Applied Sciences Research, 4(12), 1682-1693.
6. Akkila, A. N., & Abu Naser, S. S. (2016). Proposed Expert System for Calculating Inheritance in Islam. World Wide Journal of Multidisciplinary Research and Development, 2(9), 38-48.
7. Abu-Naser, S. S., Kashkash, K. A., & Fayyad, M. (2010). Developing an expert system for plant disease diagnosis. Journal of Artificial Intelligence ; Scialert, 3(4), 269-276.
8. Al Rekhawi, H. A., Ayyad, A. A., & Abu Naser, S. S. (2017). Rickets Expert System Diagnoses and Treatment. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 149-159.
9. Abu Naser, S., Al-Dahdooh, R., Mushtaha, A., & El-Naffar, M. (2010). Knowledge management in ESMDA: expert system for medical diagnostic assistance. AIML Journal, 10(1), 31-40.
10. Azaab, S., Abu Naser, S., & Sulisel, O. (2000). A proposed expert system for selecting exploratory factor analysis procedures. Journal of the College of Education, 4(2), 9-26.
11. Abu Naser, S., & El Haddad, I. (2016). An Expert System for Genital Problems in Infants. World Wide Journal of Multidisciplinary Research and Development (WWJMRD), 2(5).
12. Bakeer, H. M. S., & Naser, S. S. A. (2017). Photo Copier Maintenance Expert System V. 01 Using SL5 Object Language. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 116-124.
13. Abu Naser, S. S. (1993). A methodology for expert systems testing and debugging. North Dakota State University, USA.
14. El Agha, M., Jarghon, A., & Abu Naser, S. S. (2017). Polymyalgia Rheumatic Expert System. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 125-137.
15. Abu Naser, S. S. (1999). Big O Notation for Measuring Expert Systems complexity. Islamic University Journal Gaza, 7(1), 57-70.
16. Hilles, M. M., & Abu Naser, S. S. (2017). Knowledge-based Intelligent Tutoring System for Teaching Mongo Database. EUROPEAN ACADEMIC RESEARCH, 6(10), 8783-8794.
17. Almurshidi, S. H., & Naser, S. S. A.(2018). Expert System For Diagnosing Breast Cancer. Al-Azhar University, Gaza, Palestine.
18. Abu Naser, S., & Aead, A. M. (2013). Variable Floor for Swimming Pool Using an Expert System. International Journal of Modern Engineering Research (IJMER), 3(6), 3751-3755.
19. Dahouk, A. W., & Abu-Naser, S. S. (2018). A Proposed Knowledge Based System for Desktop PC Troubleshooting. International Journal of Academic Pedagogical Research (IJAPR), 2(6), 1-8.
20. Abu Naser, S. S. (2012). A Qualitative Study of LP-ITS: Linear Programming Intelligent Tutoring System. International Journal of Computer Science & Information Technology, 4(1), 209.
21. Almadhoun, H. R., & Abu-Naser, S. S. (2018). Banana Knowledge Based System Diagnosis and Treatment. International Journal of Academic Pedagogical Research (IJAPR), 2(7), 1-8.
22. Abu-Naser, S., Al-Masri, A., Sultan, Y. A., & Zaqout, I. (2011). A prototype decision support system for optimizing the effectiveness of elearning in educational institutions. International Journal of Data Mining & Knowledge Management Process (IJDKP), 1, 1-13.
23. Hilles, M. M., & Abu Naser, S. S. (2017). Knowledge-based Intelligent Tutoring System for Teaching Mongo Database. EUROPEAN ACADEMIC RESEARCH, 6(10), 8783-8794.
24. Abu-Nasser, B. S. (2017). Medical Expert Systems Survey. International Journal of Engineering and Information Systems, 1(7), 218-224.
25. Nassr, M.S, & Abu-Naser, S. S. (2018). Knowledge Based System for Diagnosing Pineapple Diseases. International Journal of Academic Pedagogical Research (IJAPR), 2(7), 9-15.
26. Abu-Nasser, B. S., & Abu-Naser, S. S. (2018). Rule-Based System for Watermelon Diseases and Treatment. International Journal of Academic Information Systems Research (IJAISR), 2(7), 1-7.
27. Khella, R. A., & Abu Naser, S. S. (2017). Expert System for Chest Pain in Infants and Children. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 138-148.
28. Abu-Naser, S., El-Hissi, H., & Abu-Rass, M. (2010). An Expert System for Endocrine Diadnosis and Treatment using JESS. Journal Of Artificial Intelligence, 4, 239-251.
29. AbuEl-Reesh, J. Y., & Abu Naser, S. S. (2017). An Expert System for Diagnosing Shortness of Breath in Infants and Children. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 102-115.
30. Abu Naser, S. S., & Mahdi, A. O. (2016). A proposed Expert System for Foot Diseases Diagnosis. American Journal of Innovative Research and Applied Sciences, 2(4), 155-168.
31. Mrouf, A., Albatish, I., Mosa, M., & Abu Naser, S. S. (2017). Knowledge Based System for Long-term Abdominal Pain (Stomach Pain) Diagnosis and Treatment. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 71-88.
32. Abu Naser, S. S. (2015). Sl5 Object: Simpler Level 5 Object Expert System Language. International Journal of Soft Computing, Mathematics and Control (IJSCMC), 4(4), 25-37.

33. Nabahin, A., Abou Eloun, A., & Abu Naser, S. S. (2017). Expert System for Hair Loss Diagnosis and Treatment. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 160-169.
34. Abu Naser, S. S., & Al-Bayed, M. H. (2016). Detecting Health Problems Related to Addiction of Video Game Playing Using an Expert System. World Wide Journal of Multidisciplinary Research and Development, 2(9), 7-12.
35. Naser, S. S. A., & Al-Nakhal, M. A. (2016). A Ruled Based System for Ear Problem Diagnosis and Treatment. World Wide Journal of Multidisciplinary Research and Development, 2(4), 25-31.
36. Qwaider, S. R., & Abu Naser, S. S. (2017). Expert System for Diagnosing Ankle Diseases. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 89-101.
37. Abu Naser, S. S., Baraka, M. H., & Baraka, A. (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).
38. Naser, S. S. A., & Hasanein, H. A. A. (2016). Ear Diseases Diagnosis Expert System Using SL5 Object. World Wide Journal of Multidisciplinary Research and Development, 2(4), 41-47.
39. Almurshidi, S. H., & Abu Naser, S. S. (2017). Design and Development of Diabetes Intelligent Tutoring System. EUROPEAN ACADEMIC RESEARCH, 6(9), 8117-8128.
40. Naser, S. S. A., & Hilles, M. M. (2016). An expert system for shoulder problems using CLIPS. World Wide Journal of Multidisciplinary Research and Development, 2(5), 1-8.
41. Abu-Naser, S. S., El-Hissi, H., Abu-Rass, M., & El-Khozondar, N. (2010). An expert system for endocrine diagnosis and treatments using JESS. Journal of Artificial Intelligence; Scialert, 3(4), 239-251.
42. Abu Naser, S. S., & Hamed, M. A. (2016). An Expert System for Mouth Problems in Infants and Children. Journal of Multidisciplinary Engineering Science Studies (JMESS), 2(4), 468-476.
43. Abu Naser, S. S., & Al-Bayed, M. H. (2016). Detecting Health Problems Related to Addiction of Video Game Playing Using an Expert System. World Wide Journal of Multidisciplinary Research and Development, 2(9), 7-12.
44. Abu Naser, S. S., Alamawi, W. W., & Alfarra, M. F. (2016). Rule Based System for Diagnosing Wireless Connection Problems Using SL5 Object. International Journal of Information Technology and Electrical Engineering, 5(6), 26-33.
45. Abu Naser, S. S., & Alawar, M. W. (2016). An expert system for feeding problems in infants and children. International Journal of Medicine Research, 1(2), 79--82.
46. Abu Naser, S. S., & AlDahdooh, R. M. (2016). Lower Back Pain Expert System Diagnosis and Treatment. Journal of Multidisciplinary Engineering Science Studies (JMESS), 2(4), 441-446.
47. Abu Naser, S. S., & Alhabbash, M. I. (2016). Male Infertility Expert system Diagnoses and Treatment. American Journal of Innovative Research and Applied Sciences, 2(4).
48. Abu Naser, S. S., & Al-Hanjori, M. M. (2016). An expert system for men genital problems diagnosis and treatment. International Journal of Medicine Research, 1(2), 83-86.
49. Abu Naser, S. S., & Bastami, B. G. (2016). A proposed rule based system for breasts cancer diagnosis. World Wide Journal of Multidisciplinary Research and Development, 2(5), 27-33.
50. Abu Naser, S. S., & El-Najjar, A. E. A. (2016). An expert system for nausea and vomiting problems in infants and children. International Journal of Medicine Research, 1(2), 114-117.
51. Abu Naser, S. S., & Ola, A. Z. A. (2008). An Expert System For Diagnosing Eye Diseases Using CLIPS. Journal of Theoretical & Applied Information Technology, 4(10).
52. Abu Naser, S. S., & Shaath, M. Z. (2016). Expert system urination problems diagnosis. World Wide Journal of Multidisciplinary Research and Development, 2(5), 9-19.
53. Abu Naser, S. S., & Zaqout, I. S. (2016). Knowledge-based systems that determine the appropriate students major: In the faculty of engineering and information technology. World Wide Journal of Multidisciplinary Research and Development, 2(10), 26-34.