

Expert System for Castor Diseases and Diagnosis

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Abstract: Background: The castor bean is a large grassy or semi-wooden shrub or small tree. Any part of the castor plant parts can suffering from a disease that weakens the ability to grow and eliminates its production. Therefore, in this paper will identify the pests and diseases present in castor culture and detect the symptoms in each disease. Also images is showing the symptom form in this disease. **Objectives:** The main objective of this expert system is to obtain appropriate diagnosis of the disease. **Methods:** In this paper, the expert system is designed for the ability of agricultural engineers to detect and diagnose disease of castor like as: seeding blight, alternaria blight, cercospora leaf spot, powdery mildew and wilt. This system presents the disease symptoms, survival and spread, favorable conditions and image for each disease. Clips and Delphi expert system languages are used for designing and implementing the proposed expert system. **Results:** The expert system in the diagnosis of castor diseases was assessed by farmers and agricultural engineers and they were satisfied and accepted with its quality of performance. **Conclusions:** The expert system is easy for farmers and people have experience in the plant of castor to detect and diagnosis the symptoms that may face this plant from several disease.

Keywords: Artificial Intelligence, Expert Systems, CLIPS, Delphi, Castor diseases

1. INTRODUCTION

With large leaves, a tropical appearance and granules of exotic seeds, castor bean is a strange addition to the ornamental garden. The only member of the genus, *Ricinus communis* is in the Spurge Family (Euphorbiaceae). The word *ricinus* is a Latin word meaning “tick”, and is used for this name due to the superficial similarity of the seeds to a particular type of European tick. Castor belongs to the tropics of East Africa around Ethiopia, but has been naturalized in the tropics and subtropical regions around the world to become grasses in many places, including the Southwestern United States. Plants are usually found in well-drained wet soil in disturbed areas, such as along the riverbed and on the sides of roads, in lush fields or on the edges of cultivated land.



Figure 1: shows castor trees

The castor bean is a large grassy or semi-wooden shrub or small tree. These sturdy perennials can grow to 40 feet, and the evolution of wood logs over a few years in frost-free climates. Due to its rapid and active growth, it is easily grown as a mild season in temperate climates, however rarely exceeds 6-10 feet in one growth season. This fast-growing plant tends to grow straight at first, developing branches later this season to form a bush that is consistent with strong stalks and dense canopy. This fast-growing plant tends to grow straight at first, developing branches later this season to form a bush that is consistent with strong stalks and dense canopy. The plant is killed when the temperature drops below 32F. Unlike many members of the euphorbia family, this plant does not have milky latex sap, but has a watery sap [1].

An expert system is a computer system that emulates, or acts in all respects, with the decision-making capabilities of a human expert. Its main components are: Knowledge base, it's obtainable from books, magazines, knowledgeable persons, etc. Inference engine, it draws conclusions from the knowledge base [2,14-20]. Figure 2 displays the main components.

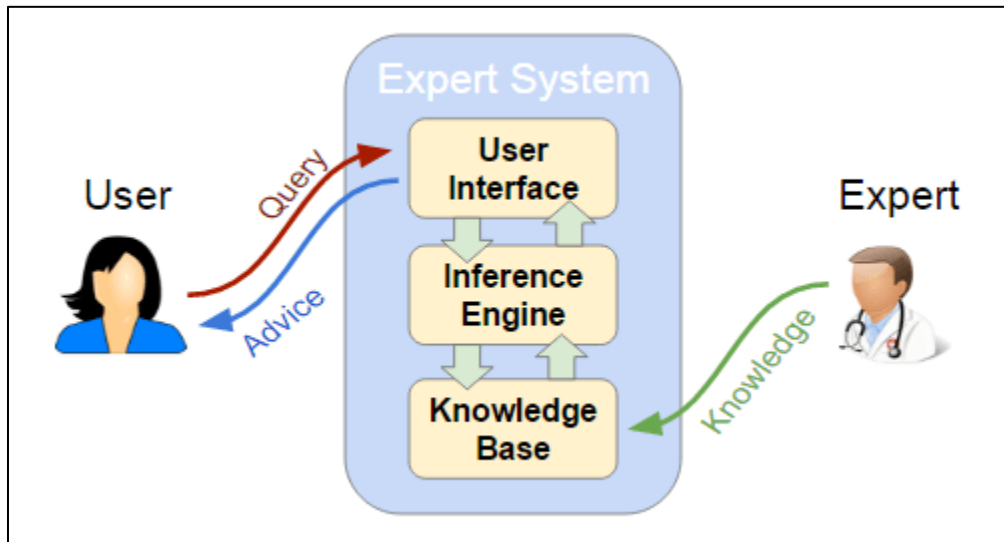


Figure 2: main components of expert system

The Expert system for Castor Diseases Diagnosis was implemented using CLIPS shell and Delphi language. CLIPS is a decent example of an expert system shell, it illustrates many of the concepts and methods used in other expert system shells, it allows the representation of knowledge, and its use for solving suitable problems[21-25].

2. MATERIALS AND METHODS

The expert system accomplish diagnosis for five castor diseases display in the leaves, can applied by display all symptoms in list and select it to analysis the disease. The expert system will ask the user to choose the symptoms that appear on castor plant from the list[26-30]. Then click analyze button to diagnosis the castor disease name, survival and spread, favorable conditions and snapshot of the disease. The expert system has been designed for change the theme for user interface like font color, background color, font name, and font size. Also it have many form, each form display specific format. For example figure 3 display the basic data for the expert system such as name and image. In the figure 4 display the format of the first user interface include name of expert system and whom designed it and background about the system. In figure 5 display the format of symptoms screen that display all symptoms in the list. In figure 6 display the format of result screen that include all details that diagnosis of the disease. In figure 7 display the format of screen entering details of disease[32-33].

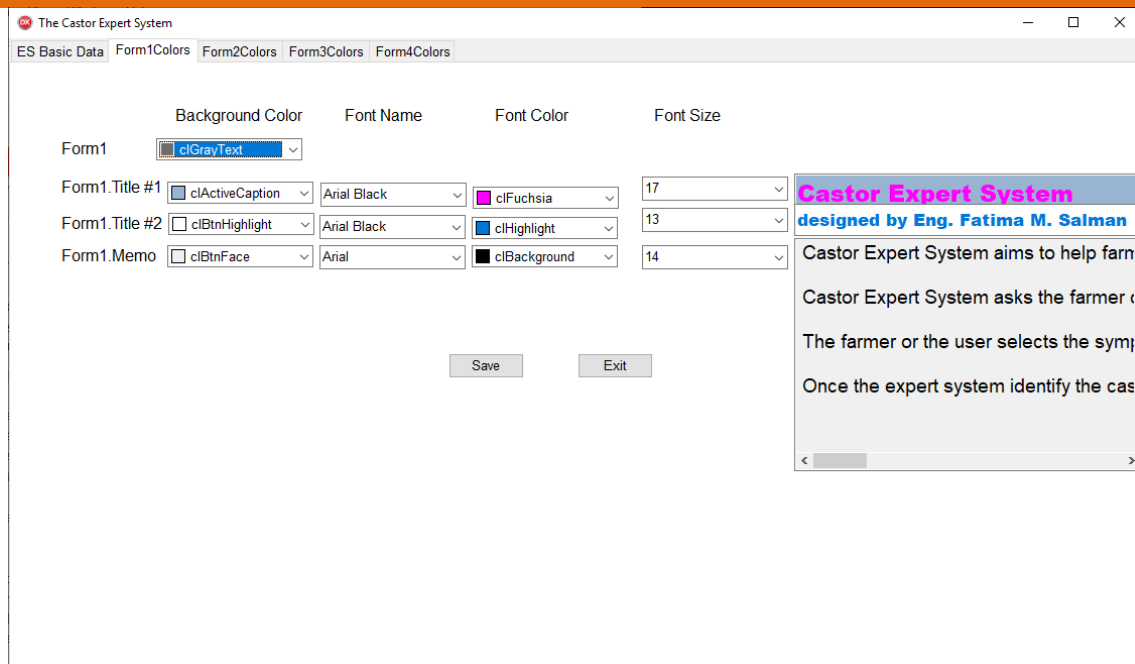


Figure 3: display the basic data for expert system

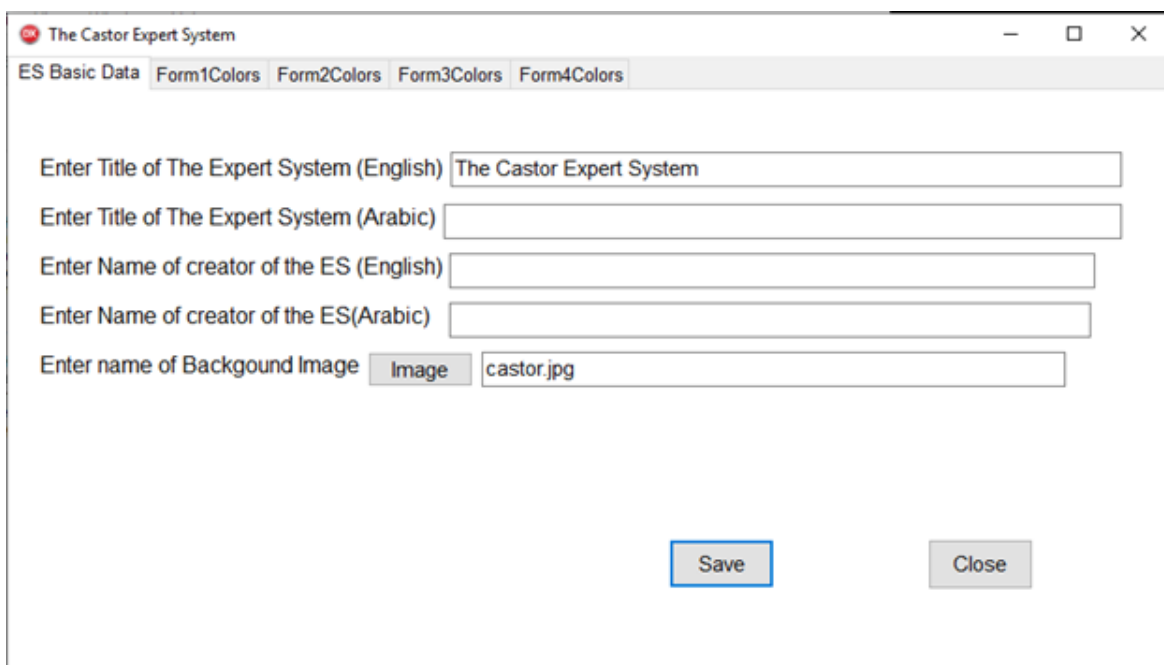


Figure 4: display format of the main page in expert system

Form	Background Color	Font Name	Font Color	Font Size
Form	clActiveCaption			
Title #1	clSkyBlue	Arial Black	clRed	14
Title #2	clSkyBlue	Arial Black	clBlue	13
List Box	clGradientInactive	Arial	clBlue	14

Save Exit

Figure 5: display format of selection symptoms.

Form	Background Color	Font Name	Font Color	Font Size
Form	clScrollBar			
Title #1	clGradientActiveC	Arial	clWindowText	14
Title #2	clGradientActiveC	Arial	clBlue	14
Title #3	clSilver	Arial	clRed	14
Title #4	clSilver	Arial	clBlue	14
Memo1	clMoneyGreen	Arial	clNavy	14
Title #5	clSilver	Arial	clBlue	14
Memo2	clMoneyGreen	Arial	clBlack	14
Title #6	clSilver	Arial	clBlue	14

Save Exit

Figure 6: display format of details screen of disease

Form	Background Color	Font Name	Font Color	Font Size	
Title #1	clSkyBlue	Arial Black	clYellow	14	Enter the Problems/Diseases and
Label #1	clGreen	Arial	clNavy	12	Disease ID
Label #2	clGreen	Arial	clNavy	12	Disease Name
Label #3	clGreen	Arial	clNavy	12	Disease Symptom1
Label #4	clOlive	Arial	clLime	12	Disease Symptom2
Label #5	clOlive	Arial	clLime	12	Disease Symptom3
Label #6	clNavy	Arial	clLime	12	Disease Symptom4
Label #7	clNavy	Arial	clLime	12	Disease Symptom5
Label #8	clPurple	Arial	clYellow	12	Disease Symptom6
Label #9	clPurple	Arial	clYellow	12	Disease Symptom7
Label #10	clPurple	Arial	clYellow	12	Disease Symptom8
Label #11	clTeal	Arial	clBlue	12	Survival and spread
Label #12	clRed	Arial	clAppWorkSpace	12	Favourable conditions
Label #13	clLime	Arial	clRed	12	Disease Image

Figure 7: display the format of entering diseases details

In the Figure 8 display the main page of the castor expert system include the details and the important of the castor expert system.

Figure 8: main page of castor expert system

In figure 9 user interface for choosing the symptoms that appear on a castor plant and click in the button analyze to display the details that is displayed in figure 9.

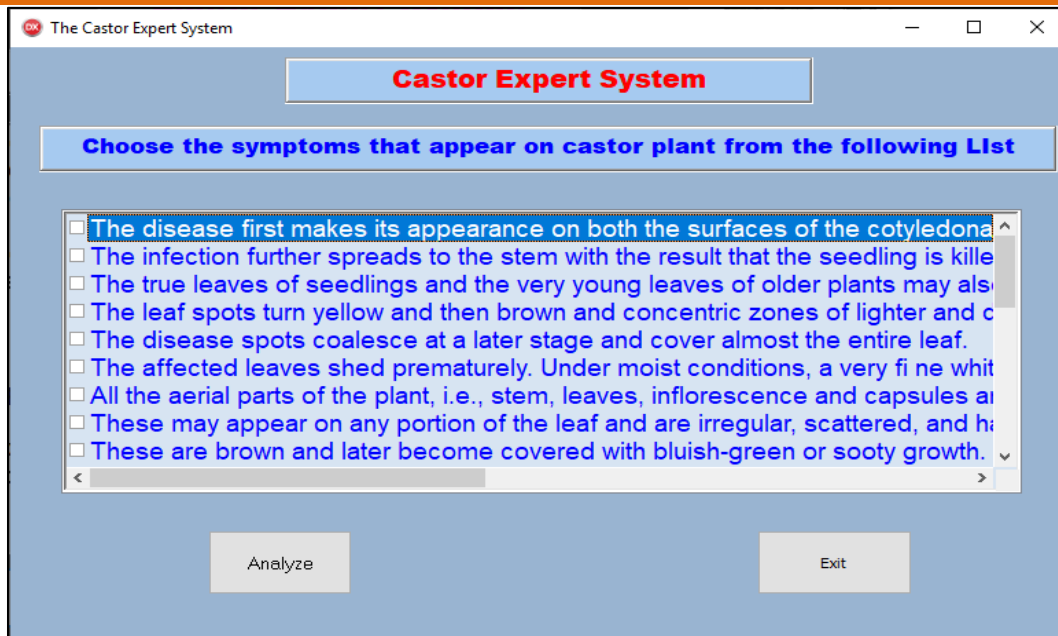


Figure 9: user interface to select the purpose symptoms

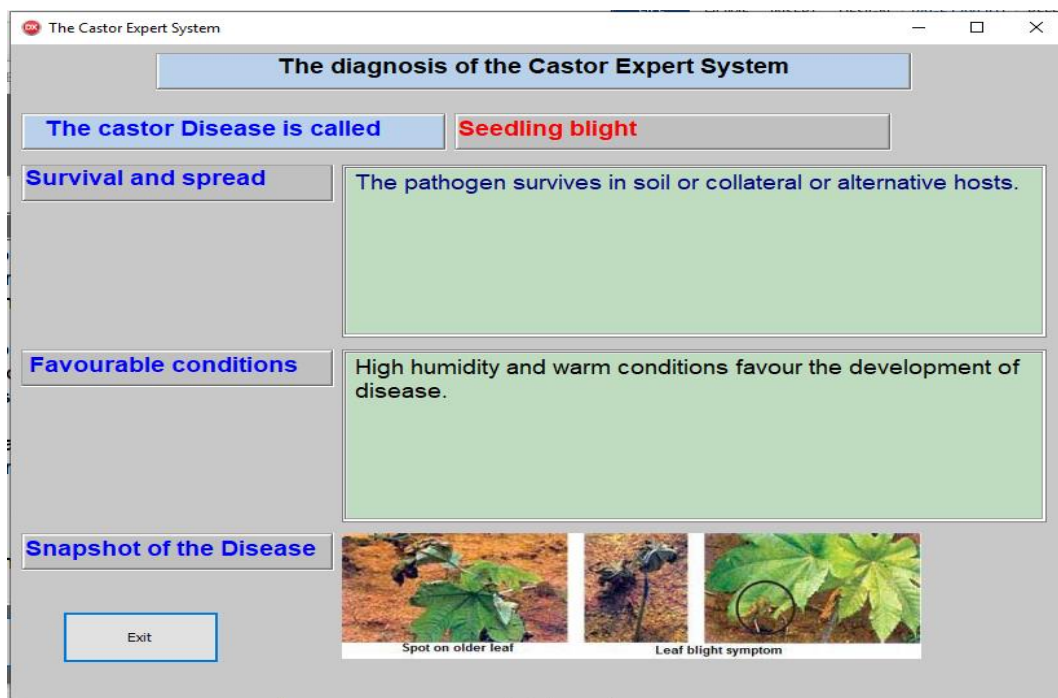


Figure 10: user interface display the details for castor disease

3. LITERATURE REVIEW

A lot of expert systems that were designed to diagnose human diseases like [35-41, 43-47], expert system which helps farmers and specialists to diagnose and get appropriate advice on plant and trees problem like: general plant [2], mango [11], Black pepper [4], banana [3, 42] onion [5], potato [34], Pineapple [7], watermelon [6], tomatoes [48], seedlings classification[49], and other kinds of diseases. However there no expert system found to diagnosis the castor diseases.

4. KNOWLEDGE REPRESENTATION

The main sources of the knowledge for this expert system are agriculture and specializes websites for castor diseases. The captured knowledge has been converted into CLIPS Knowledge base. Currently the expert system has a number of rules which cover five castor diseases [7]:

4.1 Seedling blight: It has some of disease symptoms that lead to dead seedling like as The disease first makes its appearance on both the surfaces of the cotyledonary leaves in the form of roundish patch of dull green color which soon spreads to the point of attachment causing the leaf to rot and hang down. The infection further spreads to the stem with the result that the seedling is killed either due to the destruction of growing point or by the collapse of stem. The true leaves of seedlings and the very young leaves of older plants may also be affected; but ordinarily not much injury is caused. The leaf spots turn yellow and then brown and concentric zones of lighter and darker brown color are formed. The disease spots coalesce at a later stage and cover almost the entire leaf. The affected leaves shed prematurely. Under moist conditions, a very fine whitish haze is found on the under-surface of the leaf spots.



Figure 11: The figure shows the seedling blight diseases effect

4.2 Alternaria blight: It has some of disease symptoms that have Alternaria leaf spot with concentric rings like us, all the aerial parts of the plant, i.e., stem, leaves, inflorescence and capsules are liable to be attacked. These may appear on any portion of the leaf and are irregular, scattered, and have concentric rings. These are brown and later become covered with bluish-green or sooty growth. When the attack is severe the spots coalesce and form big patches resulting in premature defoliation of the plant which gradually wilts away. In one case the capsules, when half mature, wilt suddenly, turn brown and due to collapse of the pedicel the capsules fall or hang down. They are smaller in size and have under-developed and wrinkled seeds with little oil content.



Figure 12: The figure shows the Alternaria blight diseases effect

4.3 Cercospora leaf spot: it has some of disease symptoms like as, the disease appears as minute black or brown points surrounded by a pale green ring. These spots are visible on both the surfaces of the leaf. As the spots enlarge, the center turns pale brown and then greyish-white surrounded by a deep brown band which may be narrow and sharp or broad and diff used. The fructifications of the fungus appear as tiny black dots in the white centre. The diseased spots often occur in great numbers scattered over the leaf and are roundish when young but may become irregularly angular when mature. When the spots are close together, the intervening leaf tissue withers and large brown patches of dried leaf may result.



Figure 13: The figure shows the cercospora leaf spot diseases effect

4.4 Powdery mildew: it has some of disease symptoms that have Powdery mass covering entire leaf like as, it is characterized by typical mildew growth which is generally confined to the under-surface of the leaf. When the infection is severe the upper-surface is also covered by the whitish growth of the fungus. Light green patches, corresponding to the diseased areas on the under surface, are visible on the upper side especially when the leaves are held against light.



Figure 14: The figure shows the powdery mildew diseases effect

4.5 Wilt: it has some of disease symptoms like as, Leaves droop and drop off leaving behind only top leaves. Diseased plants are sickly in appearance. Wilting of plants, root degeneration, collar rot, drooping of leaves and necrosis of affected tissue and finally leading to death of plants. Necrosis of leaves starts from margins spreading to interveinal areas and finally to the whole leaf. Spilt open stem shows brownish discolouration and white cottony growth of mycelia much prominently in the pith of the stem.



Figure 15: The figure shows the wilt diseases effect

5. LIMITATIONS

Currently the proposed expert system is specialized in the diagnosis five castor diseases: Seedling blight, alternaria blight, Cercospora leaf spot, Powdery mildew, and Wilt.

6. SYSTEM EVALUATION

As an introductory evolution, a group of farmers and Agricultural specialists 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 Agricultural specialists in diagnosing patients with five different possible castor diseases. Agricultural specialists and farmers 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 using CLIPS and Delphi XE10.2 languages.

8. FUTURE WORK

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

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