

An Expert System for Coconut Diseases Diagnosis

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Abstract:: Background: The coconut tree (*Cocos nucifera*) is a member of the palm tree family (*Arecaceae*) and the only living species of the genus *Cocos*, can refer to the whole coconut palm, the seed, or the fruit, which botanically is a drupe, not a nut. The term is derived from the 16th-century Portuguese and Spanish word *coco* meaning "head" or "skull" after the three indentations on the coconut shell that resemble facial features. **Objectives:** The main goal of this expert system is to get the appropriate diagnosis of disease and the correct treatment by presenting suggestions on coconut diseases to the user with pictures to be accurately diagnosed. **Methods:** in this paper the design of the proposed Expert System which was produced to help farmers in diagnosing many of the coconut diseases such as: Bud Rot, Leaf Rot, Stem Bleeding, Tanjore wilt and Root (wilt). the proposed expert system presents an overview about coconut diseases are given, the cause of diseases is outlined and the treatment of disease whenever possible is given out. CLIPS Object Expert System language was used for designing and implementing the proposed expert system. **Results:** The proposed coconut diseases diagnosis expert system was evaluated by agricultural engineers and they were satisfied with its performance. **Conclusions:** The Proposed expert system is very useful for agricultural engineer, specialists in plant pathology, and researchers on coconut plant.

Keywords: Artificial Intelligence, Expert Systems, CLIPS, Coconut diseases, Plant, agricultural engineering.

1. INTRODUCTION

Coconuts are known for their versatility of uses, ranging from food to cosmetics. The inner flesh of the mature seed forms a regular part of the diets of many people in the tropics and subtropics. Coconuts are distinct from other fruits because their endosperm contains a large quantity of clear liquid, called "coconut milk" in the literature, and when immature, may be harvested for their potable "coconut water", also called "coconut juice". There are many advantages of coconut oil such as:

- Coconut Oil Contains Fatty Acids with Potent Medicinal Properties.
- Populations That Eat a Lot of Coconut Oil Are Healthy.
- Coconut Oil Can Increase Fat Burning.
- Coconut Oil Can Reduce Your Hunger, Helping You Eat Less.
- The Fatty Acids in Coconuts May Reduce Seizures.
- Coconut Oil Can Protect Your Skin, Hair and Dental Health.
- The Fatty Acids in Coconut Oil Can Boost Brain Function in Alzheimer's Patients.
- Coconut Oil Can Help You Lose Fat, Especially the Harmful Abdominal Fat.



Figure 1: the coconut structure

Coconut disease is not treated in many places by agricultural engineers. In fact, the existence of agricultural engineers and specialized centers, the treatment of coconut diseases is rare in most parts of the world.

Diagnosis of coconut diseases is very complicated because the plant is small in size and the disease cannot be easily detected and predicted. And therefore, they need an agricultural engineer with extensive experience in specialized plant diseases. For all the above reasons, we have this expert system developed to help an agricultural engineer diagnose many of the diseases of coconuts, in order to prescribe appropriate treatment.

Expert System is a computer application of Artificial Intelligence (AI) which contains a knowledge base and an inference engine the main components and details are represented in figure 2.

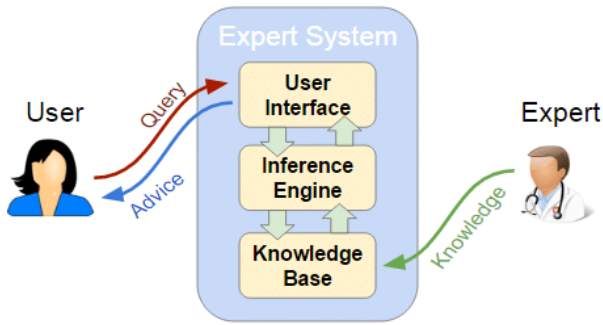


Figure 2: The figure presents the Main Components of an Expert System

The proposed Expert System for Coconut Diseases Diagnosis was implemented using, CLIPS and Delphi Languages. 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. The CLIPS engine is implemented in C language. 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 five coconut diseases of all stages of the coconut life. The proposed expert system will ask the user to choose the correct answer 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.

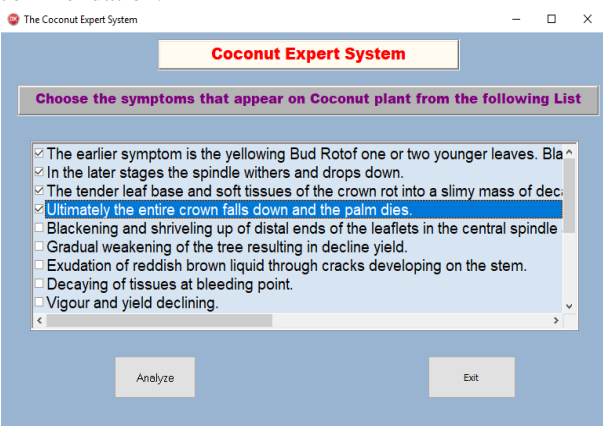


Figure 3: The figure presents shows when the system asks the user.

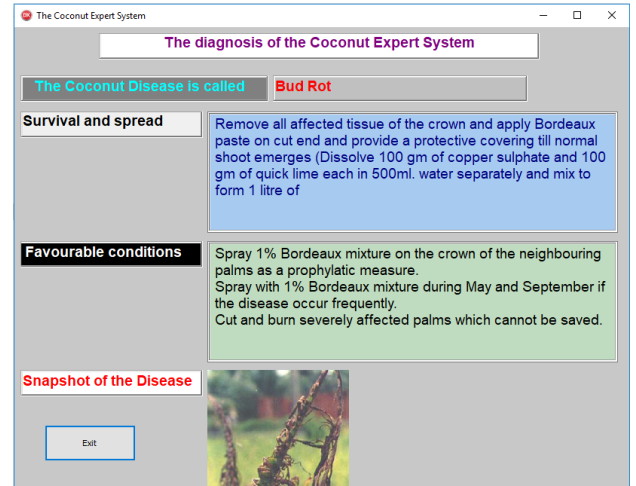


Figure 4: The figure shows diagnosis and recommendation of the expert system.



Figure 5: The figure of starting window

3. LITERATURE REVIEW

There are many expert systems designed to diagnose human diseases[5-45,47-50] and Plants diseases[51-63] such as spinach, sesame, citrus and other types of illness. But there is no expert system for the diagnosis of coconut diseases available free of charge. There are tests to detect the disease of coconut and it takes a long time to know the disease, but in this system expert we can identify five types of diseases through several questions we ask the user and after the answer is provided picture of the disease and methods of treatment and the environment recommended, Of these diseases: Bud Rot, Leaf Rot, Stem Bleeding, Tanjore wilt and Root (wilt).

4. KNOWLEDGE REPRESENTATION

The main sources of the knowledge for this expert system are Agricultural engineer and specializes websites for plants diseases. The captured knowledge has been converted into

CLIPS Knowledge base syntax (Facts, Rules)[5-8]. Currently the expert system has a lot of rules which cover five coconut diseases.

Bud Rot: Bud rot is a rare disease in Pacific island countries. Mostly, the disease affects young palms, under 5 years. In Samoa, it is limited to a mountainous, cool, wet area. Outbreaks of a seedling bud rot caused by *Phytophthora palmivora* have been recorded from coconut nurseries in Vanuatu.



Figure 6: The figure shows Bud rot disease

Leaf Rot: The root (wilt) affected coconut are susceptible to diseases such as leaf rot and pests such as rhinoceros beetle and red palm weevil.



Figure 7: The figure shows leaf rot disease

Stem Bleeding: Stem bleeding disease (resinosis) of coconut palm is caused by *Thielaviopsis paradoxa* and is very important in the state of Sergipe, Brazil. ... Three plots with 729 plants each were selected and evaluated every two months for stem bleeding incidence.



Figure 8: The figure shows Stem Bleeding disease

Tanjore wilt: Symptoms of *Ganoderma* wilt disease of coconut (*Cocos nucifera* L.), also called as Thanjavur wilt, prevalent in India, are described. ... Incorporation of organic manures in soil in coconut basins especially neem cake and irrigation during summer months reduced the severity of the disease.



Figure 9: The figure shows Thanjavur wilt disease

Root (wilt): Root (wilt) disease of coconut in Kerala, India, is characterized by irreversible flaccidity of the leaves (Radha & Lai, 1972). In the early stages of the diseasesymptoms include flattening and bending of leaflets; this is followed by ribbing at later stages. Coconut palms {Cocos nucifera L. var.



Figure 9: The figure shows Root (wilt) disease

5. LIMITATIONS

The current proposed expert system is specialized in the diagnosis only the following five coconut diseases: Bud Rot, Leaf Rot, Stem Bleeding, Tanjore wilt and Root (wilt).

6. SYSTEM EVALUATION

As a preliminary evolution, Eng. Mohammed Husein and other agricultural engineer 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 Agricultural engineer in diagnosing plants with five different possible coconut diseases. Agricultural engineer and 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 Expert System language.

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