MANGIFERA INDICA L. DIAGNOSTIC SYSTEM (MILDS)

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ABSTRACT

The Mangifera Indica L. Diagnostic System is a web based expert system that is developed to diagnose the symptoms of mango and determines its diseases. Mango crops are very sensitive that are many type of diseases attacked this crop. This expert system has found ten types of mango diseases. With the useful information provided that are the symptoms, this system helped the users to get to know the mango diseases in details. For developing this system, a web based application has been made for diagnose mango diseases. The problem occurs due to this diseases was the lack of skill in detecting the symptoms in short time. The farmers known to be the non-expert users that always having the problem in identifying the diseases. Because of the late of determining the problem, late prevention also make the management was handled in worst way. Hence, this system was developed to detect and determine the kind of disease in a very short time and quick prevention will take place to manage the problem. A rule based expert system has been applied in this system that act as expertise in this area. The knowledge system diagnoses the related symptom and overcome the result base on the matching facts.

ABSTRAK

Sistem Diagnostik Mangifera Indica L. adalah sebuah sistem pakar berasaskan web yang dibangunkan untuk mendiagnosis gejala mangga dan menentukan penyakit tersebut. Tanaman mangga yang sangat sensitif mempunyai banyak jenis penyakit yang menyerang tanaman ini. Sistem pakar telah menemui sepuluh jenis penyakit mangga. Dengan maklumat bermanfaat yang sedia yang merupakan gejala, sistem ini membantu para pengguna untuk mengetahui penyakit mangga secara terperinci. Untuk mengembangkan sistem ini, sebuah aplikasi berasaskan web telah dibuat untuk mendiagnosis penyakit mangga. Masalah berlaku kerana penyakit ini adalah kurangnya kemahiran dalam mengesan gejala dalam masa yang singkat. Para petani dikenali sebagai pengguna bukan ahli yang selalu mempunyai masalah dalam mengenalpasti penyakit. Oleh kerana kelewatan menentukan masalah, pencegahan yang lewat juga membuat pengurusan ditangani dengan cara yang paling buruk. Dengan demikian, sistem ini dibangunkan untuk mengesan dan menentukan jenis penyakit dalam waktu yang sangat singkat dan pencegahan cepat akan berlangsung untuk menguruskan masalah. Sebuah sistem pakar berasaskan Peraturan telah dilaksanakan dalam sistem ini yang bertindak sebagai pakar di bidang ini. Sistem pengetahuan diagnosis gejala berkaitan dan mengatasi dasar hasil pada fakta-fakta yang sesuai.

ABSTRACT

The Mangifera Indica L. Diagnostic System is a web based expert system that is developed to diagnose the symptoms of mango and determines its diseases. Mango crops are very sensitive that are many type of diseases attacked this crop. This expert system has found ten types of mango diseases. With the useful information provided that are the symptoms, this system helped the users to get to know the mango diseases in details. For developing this system, a web based application has been made for diagnose mango diseases. The problem occurs due to this diseases was the lack of skill in detecting the symptoms in short time. The farmers known to be the non-expert users that always having the problem in identifying the diseases. Because of the late of determining the problem, late prevention also make the management was handled in worst way. Hence, this system was developed to detect and determine the kind of disease in a very short time and quick prevention will take place to manage the problem. A rule based expert system has been applied in this system that act as expertise in this area. The knowledge system diagnoses the related symptom and overcome the result base on the matching facts.

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CHAPTER 1

INTRODUCTION

1.1   Introduction

Mango or Mangifera Indica L. is a kind of seasonal fruits are widely grown in tropical and subtropical climates. It is believed to have originated from India or Burma and also from Southeast Asia because of the large number of species found in this area. Among the major exporting countries of mango in the world is India, East Africa, Sri Lanka, Brazil, Mexico and some Southeast Asian countries like Malaysia, Philipine, Indonesia and Thailand. Total exports of Malaysia are very small compared to other countries because of low production.

A mango plant was one of our famous local fruits in Malaysia. These plants have produced a wide range of revenue to farmers.

However, it becomes an inconvenience to identify the type of diseases that attack this crop. Farmers need to know the type of this disease as soon as possible so that the handling of this disease can be done immediately.

1.2 Problem statement

There are various types of diseases of this crop that affected the product of Mangifera Indica L. or also known as mango in local fruit. Naturally, the mango crop diseases caused by insect pests. These diseases were recognized based on symptoms or changes happened at the stem, leaf and fruits.

Current system to identify the problem was actually by doing observations regularly. The data uses are based on written document and logical thinking. However, the data will probably lose if the documents are not sorted properly.

By using expert system based on rule based, all the data will be kept in database. Data can be update depends on the expert request. This application can imitates human thought and making decision almost accurate like the expert.

1.3 Objectives

The objectives of this research are:

i. To develop a web-based prototype application in finding the Mangifera Indica L. diseases.

ii. To implement expert system in the application that capable to detect diseases of Mangifera Indica L.

1.4 Scopes

The scopes of this research are:

i. This system is developed for Pejabat Pertanian Jubli Perak, Indera Mahkota, Kuantan Pahang.

ii. The users of this system are the farmers and expert officers from Pejabat Pertanian Jubli Perak, Indera Mahkota, Kuantan Pahang and near area of Kuantan.

iii. The system is web-based application with rule based applied.

iv. All the data and information from Department of Agriculture and farmers who own and works at mango orchard.

v. The system is developed for identifying the type of diseases based on data collected.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

This chapter describing about the review of current expert system, the development of MILDS expert system and some discussions of expert system studies that brings out this research. The purpose of this chapter is to make clear understanding about expert system studies.

2.2   Expert System

An expert system is an application that attempts to provide an answer to a problem, or to clarify uncertainties where normally one or more human experts would need to be consulted. Expert system is most common in a specific problem domain, and is a traditional application and/or subfield of artificial intelligence. A wide variety of methods can be used to stimulate the performance of the expert however common to most or all are the creation of a knowledge base which uses some knowledge

representation formalism to capture the Subject Matter Expert's (SME) and codifying it according to the formalism, which called knowledge engineering. [5]

The expert was acknowledged by a person who has deep knowledge of both facts and rules and strong practical experience in a particular domain. In general, an expert is a skillful person who can do things where other people cannot. [5]

2.2.1 Rule-based expert system

The most popular expert systems are rule-based systems. A great number have been built and successfully applied in such areas as business and engineering, medicine and geology, power systems and mining.

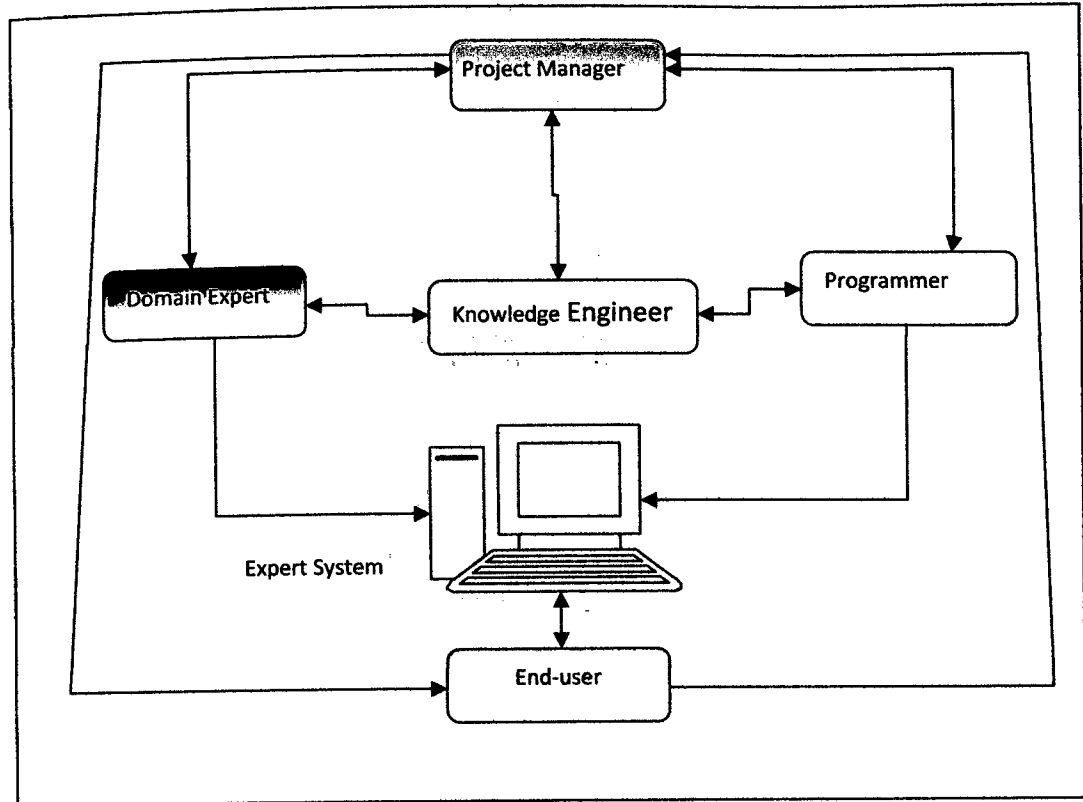## 2.2.2 Component of expert system development

Figure 2.1: Expert System Development Team. [5]

Figure 2.1 shows the person involved in Expert System Development Team. The involved people are Domain Expert, Knowledge Engineer, Programmer, Project Manager and End-user.

2.2.2.1 Expert System Development Team Explanation

Figure 2.1 shows the person involved in expert system development. There are five members or component in the expert system development team. There were domain expert, knowledge engineer, programmer, project manager and end-user.

The domain expert is a knowledgeable and skilled person capable of solving problems in a specific area or domain. This person has the greatest expertise in a given domain. An expert must be able to communicate his or her knowledge and willing to participate in the expert system development and also commit a substantial amount of time to the project. [5]

A knowledge engineer is someone who is capable of designing, building and testing an expert system. He or she has the responsibility for selecting an appropriate task for the expert system. This person interviews the domain expert to gain knowledge or solution on how the problem being solved. It is also known as artificial intelligence specialist responsible for the development of knowledge based application. Duties usually include knowledge elicitation, representation, and coding. [12]

The programmer is responsible for actual programming describing the domain knowledge in terms that a computer can understand. This person needs some skills symbolically in programming language such as Prolog, LISP, and OPSS and also some experience in the application to be built.

The project manager is the leader of the expert system development team, responsible for keeping the project on track. He or she makes sure that all deliverables and milestones are met, interacts with the expert, knowledge engineer, programmer and end-user.

The end-user, often called just the user, is a person who uses the expert system when it is developed. [5]

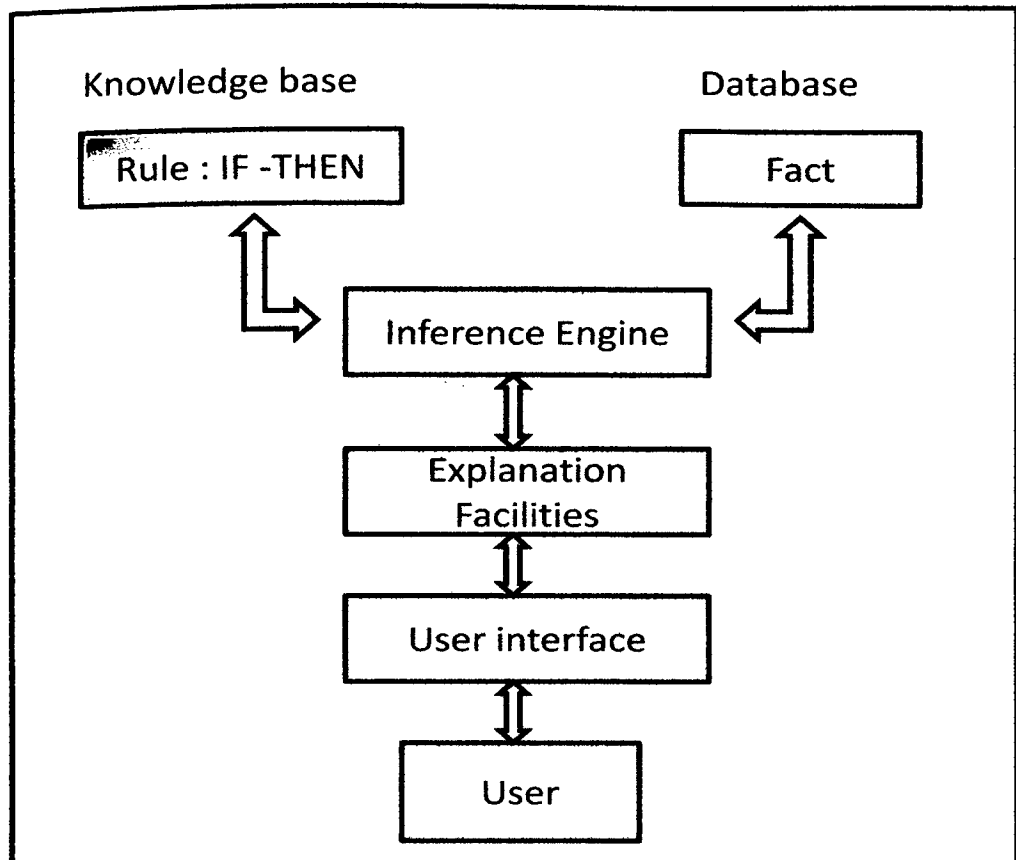### 2.2.3 Structure of a rule-based expert system

Figure 2.2: Structure of rule-based expert system. [5]

Figure 2.2 shows the basic structure of rule-based expert system. It shows how the subject connected between each other and how the subject works together as an expert system. The subjects consist of Knowledge base, Database, Inference Engine, Explanation Facilities, User Interface and User.

2.2.3.1   The Structure of Rule-Based Expert System Explanation [5]

Figure 2.1 shows the basic structure of rule-based in expert system. The knowledge base contains the domain knowledge useful for problem solving. In a rule-based expert system, the knowledge is represented as a set of rules. Each rule specifies a relation, recommendation, directive, strategy or heuristic and has the IF (condition) THEN (action) structure.

The database includes a set of facts used to match against the IF (condition) parts of rules stored in the knowledge base.

The inference engine carries out the reasoning whereby the expert system reaches a solution. It links the rules given in the knowledge base with the facts provided in the database.

The explanation facilities enable the user to ask the expert system how a particular conclusion is reached and why a specific fact is needed. An expert system must be able to explain its reasoning and justify its advice, analysis or conclusion.

The user interface is the means of communication between a user seeking a solution to the problem and an expert system. The communication should be as meaningful and friendly as possible.

2.2.4 Forward Chaining

Forward Chaining inference engine is one of the techniques used in expert system. Forward chaining is the data-driven reasoning. The reasoning starts from the known data and proceeds forward with the data. Each time, only the topmost rule is executed. When fired, the rule adds a new fact in the database. Any rule can be executed only once. The match-fire cycle stops when no further rules can be fired [10]. Figure 2.2 shows the example of how the forward chaining works.
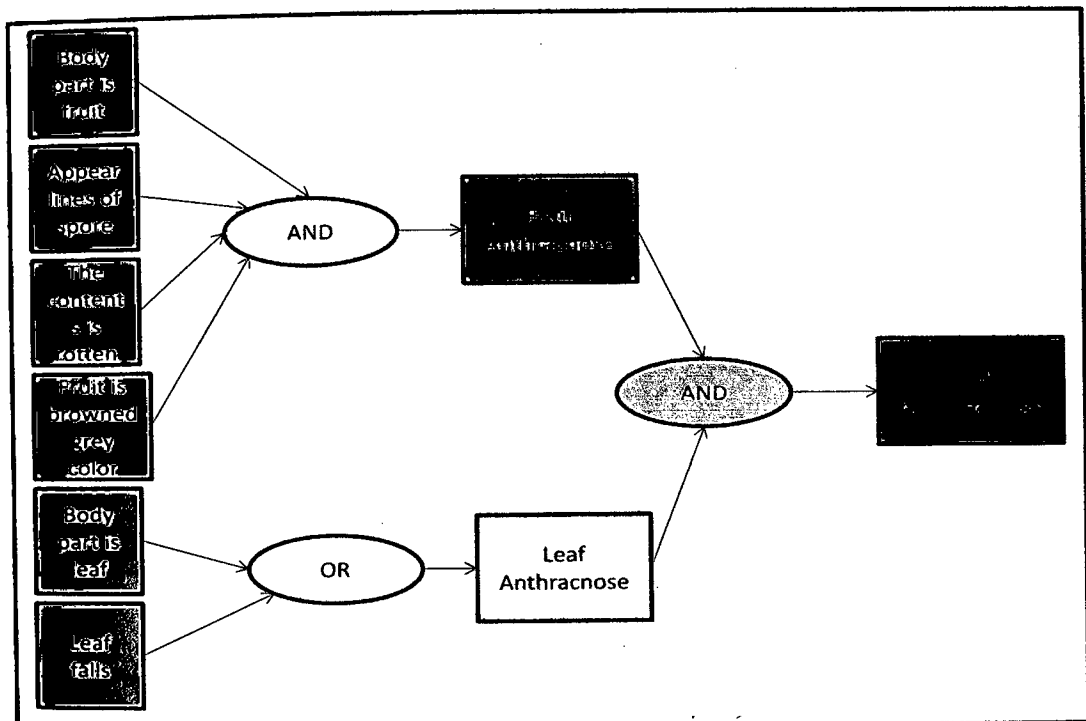

Figure 2.3: Forward Chaining. [5]

The figure 2.3 above shows how the forward chaining works. When all the desired facts matched, then it will fire to the disease in the database.

2.2.5 Backward chaining

The Backward Chaining is the goal driven reasoning [5]. Expert system has the goal (a hypothetical solution) and the inference engine attempts to find the evidence to prove it. Figure 2.4 below shows how the backward chaining works.
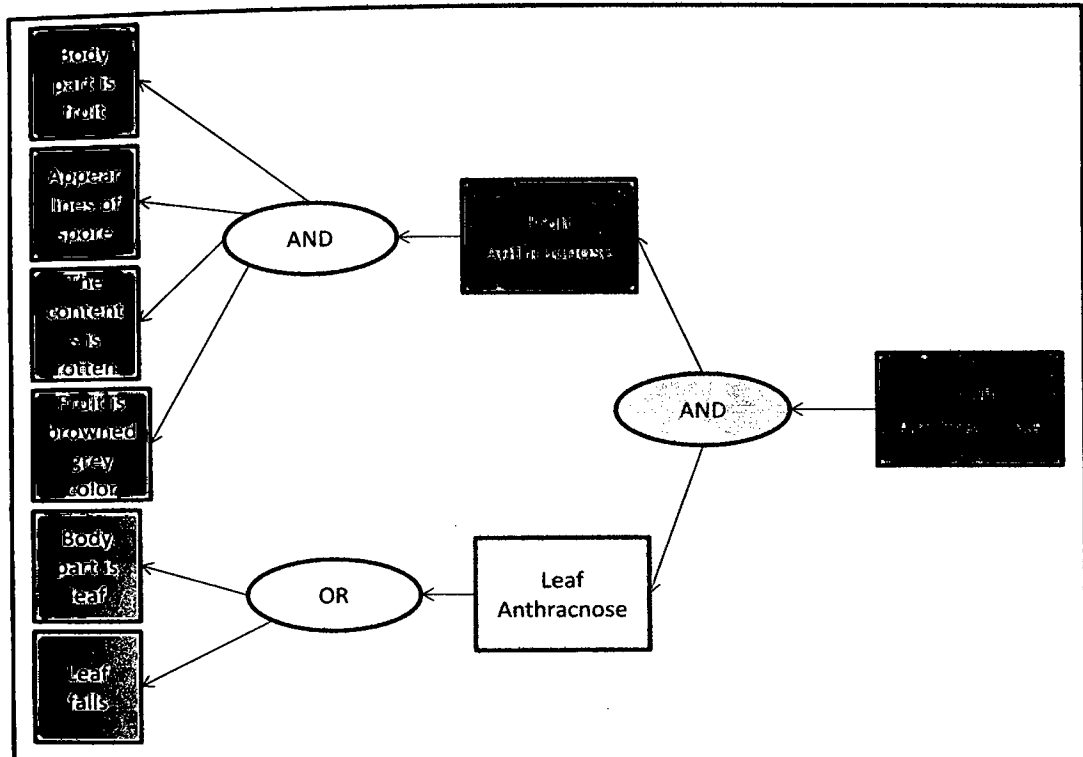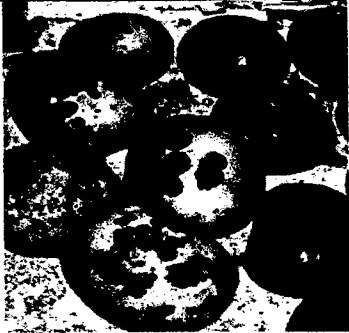

Figure 2.4: Backward Chaining. [5]

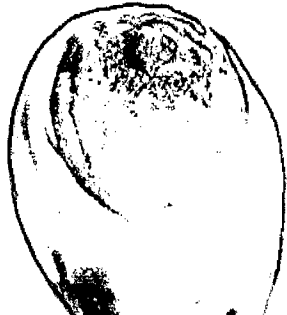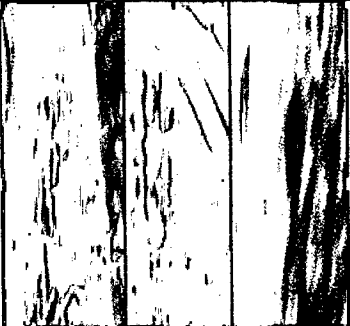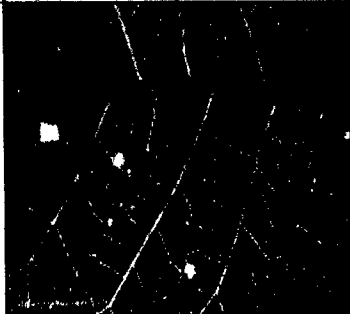Figure 2.3 above shows how the backward chaining works. From the result in the database, it will trace the fact by tracing it from bottom to the top.

2.3 Mangifera Indica L. diseases

Table 2.1: The symptoms of Mangifera Indica L. [1] [2]

Diseases	Symptom	Sample Picture
Fruit Anthracnose	the body part is fruit have 5mm spot have browned grey spot have crack at the spot have lines of spore when wet have pink ring when wet the tip is black the content decays the content rotten	
Flower Anthracnose	the body part is flower have small spot have necrotic in the bud have black color in the bud the whole bunch of flowers dries have black color of flower the fruit set falls the tissue under the necrotic decays the flower is fade	
Leaf Anthracnose	the body part is leaf have small necrotic spot have round spot have circular spot the spot larger when wet the spot is light brown color the spot is browned grey color the spot is dark brown color have holes at the leaves the leaf falls	
Algal Spot	the leaf have spot 5 mm have rusted brown color have browned green spot have black spot have orange spot have dried white spot the bark peels have crack grey spot	

Black Mold	the mango shoots died have black spot like velvet the spot not same shape have around 1cm large spot have black mold at leaves have black mold at stems have black mold at branch	
Black Soot	there is part sooty have black thin layer at fruit have tears flow pattern at fruit the leaf dry have loose network like velvet at the leaf lack of photosynthesis area	
Crusty leaf spot	the part of body is leaf have dark spots arise have hard dark spot have round dark spot have oblong dark spot spot is easy remove have yellowish spot color	
Cortitium Salmonicolor	the tree is age around 5-15 have white silk thread at stem have white silk thread at branch have white silk thread at bark the branch dries the branch dead have pink thread	

Stem End Rot	the mango tip is matured the tip is dark purple the tip is dark grey the tissue is soft the tissue is watery the fruit is rotten after 3 days	

Table 2.1 shows the diseases and the symptoms of Mangifera Indica L. with the sample pictures for each disease.

2.4 The Application by Using Expert System

2.4.1 Online Freshwater Fish Disease Diagnostic System [7]

This prototype application was made by Vanessa Anak Pawie, Faculty of Computer Systems & Software Engineering, University Malaysia Pahang. This application has been developed for freshwater fish disease diagnostic.

This application applied linear model methodology in the system development process. A rule based expert system technique is implemented in this project which will represent the knowledge from freshwater fish experts into the form of rules and using forward chaining for reasoning process.

In the development stage, the tool Macromedia Dreamweaver MX 2004 was used to design the interfaces of the prototype. The database for this application was developed in MySQL database. The programming used for this application was designed using PHP language in order to execute the speed of prototype performance.