

Agricultural Extension through Knowledge Based Expert Systems

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Abstract: Production in agriculture has evolved into an integration of knowledge and information from many diverse sources at required time. In order to increase productivity and quality, the farmer often relies on agricultural experts and advisors to provide right information for decision making. Many time agricultural expert or advisors are not available all the time. In order to overcome this problem, knowledge based expert systems were identified as a useful and helpful tool for decision making. In agriculture, expert systems combine the accumulated expertise of individual disciplines into a framework that addresses the specific needs of farmers. This paper briefs the potential of agricultural expert system and its model.

Keywords: Knowledge Based System, Knowledge Base, Agricultural Expert System.

1. INTRODUCTION

Expert systems have recently attracted the attention of agricultural scientists. These Systems are used for application in a variety of information development and transfer situations. These systems combine the inferential, experimental and simulated knowledge. Maintaining knowledgebase will help farmers to access the information for day-to-day operations and future planning. Expert systems make availability of all the extension and advisory services. The need of expert systems for technical information transfer in agriculture can be identified by recognizing the problems.

Knowledge based systems are designed to simulate one or more of the ways, that a human expert uses his or her knowledge and experience in providing recommendation. The main advantage of expert system is not only the easy access to expert solution but also to enhance the performance of average worker to the level of an expert.

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The expert system must be developed in local languages which will help the farmers to develop their own expertise which in turn will enhance the production and productivity of crops. This expert system may be made available at common places in the remote villages which can act as information center for the farmers in the villages. Knowledge-based systems offer considerable potential to help us organize and transmit problem-solving expertise. This should foster and stimulate application of agronomic knowledge in concepts.

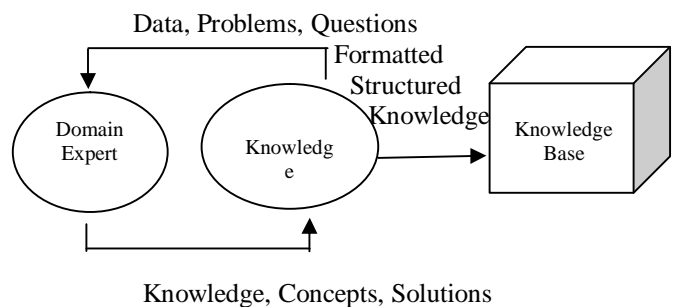


Fig 1: Knowledge Acquisition Process in Expert System

2. KNOWLEDGE- BASED SYSTEMS

One of the important lessons learned in Artificial Intelligence during 1960s that is called general purpose problem solvers. It used a minimum number of laws or axioms to solve problems of any complexity. This realization led to design knowledge- based systems which depend on a rich base of knowledge to perform difficult tasks which is called as expert system. Knowledge-based systems simulate process of human decision-making, learning, and reasoning. They are domain dependent and provide intelligent decisions with justification. Since this realization, much of the work done in Artificial Intelligence has been related to knowledge- based systems. The work is done in vision, learning, general problem solving and natural language understanding. The Knowledge-based systems consists of following components: [1]

- a) **Knowledge Base-** It is an information repository that provides a means for information to be collected, organized, shared, searched and utilized. It is a special kind

of database for knowledge management. It consisting of a set of rules. It contains facts and rules about some specialized knowledge domain. Knowledge is stored in a knowledge base separate from the control and inference components. This makes it possible to add new knowledge or refine existing knowledge without recompiling the control and inference programs.

- b) **Input / Output (Knowledge Acquisition) Unit** - Knowledge acquisition is the process of adding new knowledge to a knowledge base and refining or otherwise improving knowledge that was previously acquired.
- c) **Inference Engine** - It derives a conclusion from the facts and rules contained in the knowledge base using various artificial intelligence techniques.
- d) **Domain expert** -The individual who is provides expert knowledge in the domain to Knowledge Engineer.
- e) **Knowledge Engineer** -The individual who acquires and represents the knowledge in Knowledge Base.
- f) **Explanation facility** -The software component that answers questions such as "Why" and "How."
- g) **Blackboard**--A workplace for storing and working on intermediate information
- h) **Reasoning improvement**--A facility (not available commercially) for improving the Reasoning capabilities of an Expert System.
- i) **User**-The non-expert who uses the machine for consultation.
- j) **Hardware**--The hardware that is required to operate the Expert System.

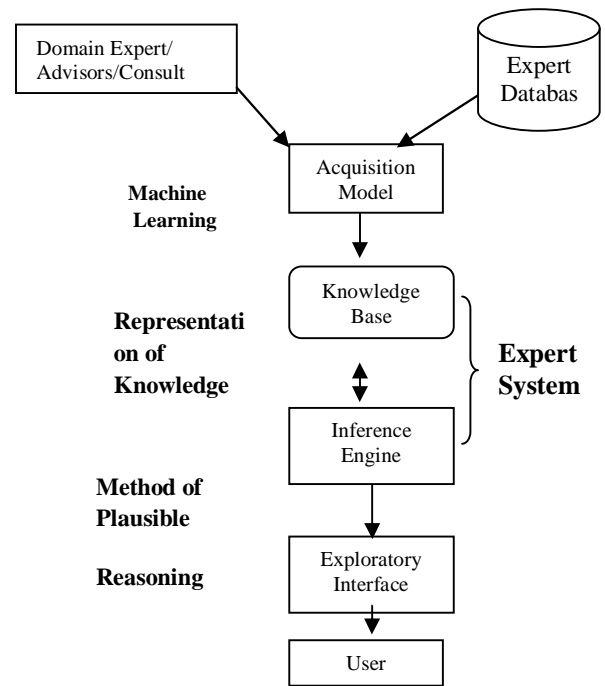


Fig 2: Expert System architecture

3. KNOWLEDGE BASED EXPERT SYSTEM AS FARMING ASSISTANCE

The working in farming is done dependently in different level by concern element. There are three levels in which the basic process of agriculture is happening.

- a) Low level farmers.
- b) Middle level agricultural officers / advisors / consultants.
- c) Higher level research institutions.

Each level requires a data depending upon its requirements with interrelationships among them. The farmers interface is designed in such a way that, the communication between the expert system and the farmer will be in the farmers understandable language. The knowledge base acts as a bridge between farmers and research institutions. The production systems at farmer's level knowledge base are not able to find an answer are formed as unanswered dynamic framers and tried for solution by agricultural officers. These frames are transferred to research institutions with the same additional view of points of agricultural officers. Hence research institutions can come to know about the new undiscovered problems that exist at farmer's level.

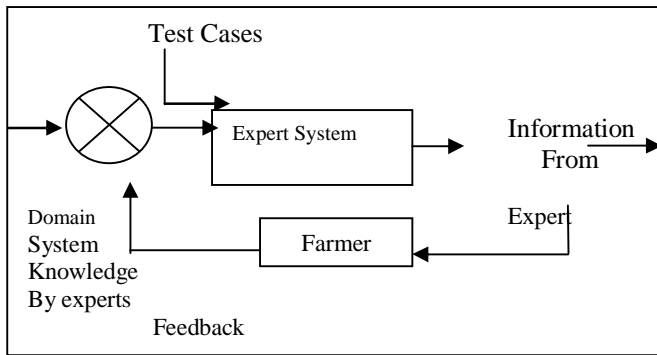


Fig.3: Block diagram of Agricultural Expert System

4. POTENTIAL OF AGRICULTURAL KNOWLEDGE BASED EXPERT SYSTEM

The need of agricultural knowledge based expert systems can be identified by recognizing the problems in using the regular system for technical information transfer and feasibility. It simulates human reasoning about a problem domain, rather than simulating the domain itself. It performs reasoning over representations of human knowledge. It solves problems by heuristic or approximate methods. The issues on Fertilizer and Seed distribution, Agricultural Product Marketing, Land-Water Management, Cropping Pattern, Management of Natural Resources and extension services can be solved through various techniques of modeling and agricultural expert systems.

The agriculture expert system also allows a high-level expert to be replaced by a subordinate expert aided by the expert system. The main purpose of the expert system considers a delivery system for extension information providing management education to farmers, and dissemination of up-to-date scientific information in a readily accessible and easily understandable way to agricultural researchers, advisers and farmers.

5. BENEFITS OF USING KNOWLEDGE BASED EXPERT SYSTEM IN AGRICULTURE

- It can be used to imitate human thought and reasoning.
- It makes modification in knowledge timely.
- Knowledge interpretation and its transparency make an interaction more user-friendly.
- It is used to acquire knowledge automatically using learning technique directly from experimental data and real time examples.
- The acquired knowledge helps to provide the right information at required time.
- It can provide accurate guidance to farmers for decision making.

6. AGRICULTURAL EXPERT SYSTEMS IN INDIA

There is no single extension approach, which can provide the information of expected return from a selected crop with given inputs before it is grown. But, it is proven now that expert system of extension, which consists knowledge based information, decision rules and inference engine will be able to help the farmers not only in taking decision to what to cultivate but also the related questions. In India, the agriculture sector is now hugely extended by the applications experts systems in various aspects. Following are some expert systems which are used in agriculture sector of India for rural development.

a) Rice-Crop Doctor

National Institute of Agricultural Extension Management has developed an expert system to diagnose pests and diseases for rice crop and suggest curative measures. [2]

b) DIAGNOS-4

Kerala Agricultural University developed an Agricultural Expert System for diagnosing pests and diseases of nine major crops of Kerala called 'DIAGNOS-4' which has drawn tremendous attraction from extension personnel. The user when selects a complaint, a list of symptoms will appear on the screen. [7]

c) Indian Institute of Horticultural Research Institute, Bangalore

The first software for use by the grape cultivators was prepared by the Indian Institute of Horticultural Research Institute, Bangalore. This spontaneous response made them to undertake similar software for providing guidance to mushroom cultivators, which became extremely popular and a large number of growers using it regularly for getting solutions to their problems. [3]

d) AGREX

Center for Informatics Research and Advancement, Kerala has prepared an Expert System called AGREX to help the agricultural field personnel give timely and correct advice to the farmers. This expert system find extensive use in the areas of fertilizer application, crop protection, irrigation scheduling, and diagnosis of diseases in post-harvest technology of fruits and vegetables.[3]

e) Farm Advisory System

Punjab Agricultural University, Ludhiana, has developed the Farm Advisory System to support agri-business management. The conversation between the system and the user is arranged in such a way that the system asks all the questions from user one by one which it

needs to give recommendations on the topic of farm Management.[4]

f) Maize AgriDaksh

It is the first online expert system developed by IASRI (Indian Agricultural Statistics Research Institute, New Delhi) in collaboration with Maize Research, New Delhi using AgriDaksh. It provides ICT based advisories on Maize crops and allows interaction with experts using internet. [7]

g) Ontology Based Expert System

The system is designed to help farmers to take appropriate decisions and disseminate need based research findings to millions of the farmers at a time which is neither feasible nor practical by conventional system of extensions. [7]

7. CONCLUSION

Expert systems in agriculture revealed their importance as tool for information transfer through information generation from knowledge and expertise. This paper deals with the need of expert systems in agriculture and availability of it for various aspects. The model of agricultural expert system is led to generate formatted structure knowledge.

8. REFERENCES

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