International Journal of Artificial Intelligence and Expert Systems (IJAE)
Singaporean Journal of Scientific Research(SJSR)
Vol5.No.1 2013 pp 8-12.
available at:www.iaaet.org/sjsr
Paper Received :05-05-2013
Paper Accepted:12-06-2013
Paper Reviewed by: 1.William Androuse 2. Bin Cao
Editor : Prof. Javad Alirezaie

AN EXPERT SYSTEM APPROACH FOR IMPROVEMENT OF AGRICULTURE DECISION

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ABSTRACT

The idea to present the paper on Expert System (ES) approach to improve agriculture decision which is intended to be used by rural farmers and decision makers. In the world of computer science there are many expert system has been developed for agriculture but this paper particularly discussed the problem facing by former in rural areas in India due to lack of education and awareness of immerging technology. The Expert System in agriculture is a simple and based on agriculture related problem solving models; include Diagnostics model, Prediction model and Form Management model. This expert system will allow former to interact with Expert System (ES) and can get the solution over the defined problem. It uses the stored knowledge of step by step solution over the problem, in database which is the captured expertise of experience people and doctorate people in the field of agriculture through IF-THEN rules and facts, which are used to solve problem by answering question asked by user through interface which will be GUI based Audio, Video and Image based interaction between former and ES. For example,

1) In pest control, which pesticide use to spray by only questioning symptoms of disease.
2) Selection of fertilizer and quantity by describing the health of crop.
3) What irrigation level to be maintained at particular age of crop. Etc.

Keywords: Artificial Intelligence, Expert System, Rural Agriculture, Expertise, Information Technology.

1. INTRODUCTION

There are many key factors in the field of Agriculture which degrade Production. To improve the production of agriculture there should have proper and accurate management and decision; Artificial Intelligence programs that achieve expert-Level competence in solving problems in task areas by bringing to bear a body of knowledge about specific task are called knowledge based or expert system [1]. Expert system is branch of Artificial Intelligence which deals with helping Non-Expert to find solution to complex problem in a more Expert-Like fashion [2]. Expert Systems use human Knowledge to solve problems that normally would require human intelligence. This Expert System represents the expertise knowledge as data or rule within the database. These data and rule can be called upon when needed to solve problems. Book

and manuals have tremendous amount of knowledge but a human has to read and interpret the knowledge for it to be used. Conventional computer programs perform task using conventional decision making logic containing little knowledge other than the basic algorithm for solving that specific problems and necessary boundary conditions. The ability of this system to explain the reasoning process through back-traces and to handle level of confidence and uncertainty provides additional features that conventional program doesn't handle [5].

The Expert System in agriculture is a simple Expert System based on agriculture related problem solving models, include diagnostics model, prediction model and form management model. This expert system will allow former to interact with their regional language with the system and can get the solution over the defined problem. There are already developed Expert System in the world and have been given quite satisfactory improvement in the decision making namely: CITEX for citrus cultivation [6], NEPER for wheat cultivation [7], and CUPTEX for cucumber cultivation under plastic tunnel [8].

The mentioned structure of simple expert system models is given in figure.

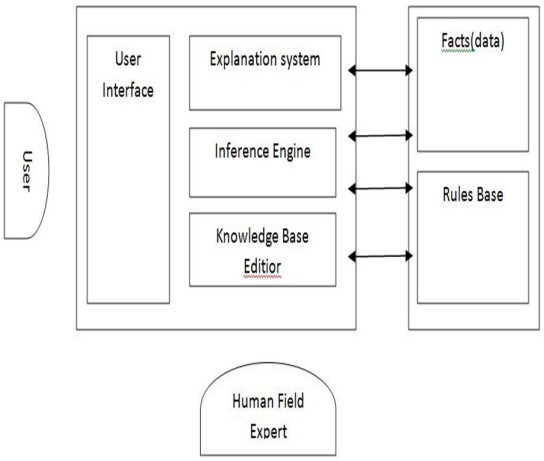

Figure. 1 Structure of Expert System

1. Database Management System

This component is used to store all database related to agriculture field it could be connected to external source of data like other data warehouse from where it can extract required data which supportive to defined problem.

2. Model base management system

The Model base Management system (MBMS) is a database where relation of different problem solving models are maintained for ex. Diagnostic model for agriculture, prediction model etc. The programmed logic is implemented to query processing system and language processing system which will responsible to respond users query.

3. Workplace (Working memory)

This is a temporary memory where Expert System (ES) performs manipulation on user query to find the exact meaning and extract related data from database.

4. User interface

Through which user can interact with the system in their regional language to define occurred problems or to get any suggestion with current observation or symptoms of crop disease.

5. External Data sources

External data source are connected online with database of ES to get related current and updated information through internet or any other data warehouse.

6. Knowledge base

It is the Extracted Expertise of expert people on their domain in agriculture field and different techniques of problem solving with reasoning capability to present solution of defined users problems. The knowledge base is extracted in IF-THEN form of questioning and answering of particular problem.

7. Knowledge engineer

Knowledge engineers are the persons who relate the knowledge base with given query and the way it can be solve, he designs algorithm for solving particular model related task.

8. User

Users are the formers who are going to interact with Expert System (ES) by defining the problems through user friendly interface.

2. NEED FOR AGRICULTURE DECISION SYSTEM

The expert systems in agriculture will help to technical information transfer in agriculture can be identified by analyzing the problems in the traditional system for technical information transfer, and by proving that expert systems can help to provide solution over the problems addressed, and are feasible to be developed [9]. The information transfer problems have been identified as follows:

Information unavailability: The required Information may not be available in any form of media. It is only available from human experts in the field of agriculture, and experienced formers. In addition, the information transfer from specialists & scientists to farmers represents a bottle neck for the development of agriculture on the national

level. The current era is witnessing a vast development in all fields of agriculture. Therefore there is a need to transfer the information of experts in certain domain to the general public of farmers, especially that the number of experts in new technologies is lesser than their demand [10].

Barriers in Indian society: India is a emerging knowledge society by which remote former can access the information using IT resources [11]. Bu there are certain barrier in Indian society like Poor literacy rate, Language barriers Unawareness of technology, Unavailability of skilled human resources, To achieve knowledge society need to break these barriers in agriculture sector; by providing Expert System facilities for rural former these barrier can be break somewhat [12].

The starting point for this system represents already developed Agriculture model, which is a computer program used to help farmers by meeting their decisions concerning different crop production and investment. Especially it is emphasized on the impact of the right decision on right time and at particular conditions by using programmed knowledge of domain experts.

3. PROBLEMS WITH RURAL AGRICULTURE

- *Poor Farming Techniques & Agricultural Practices*

The Rural farmers in India have been adopting orthodox & inefficient methods & techniques of cultivation.

- *Inadequate Use of Inputs*

Indian agriculture has been suffering from inadequate use of inputs like fertilizers & seeds. The Rural Indian farmers are not applying required sufficient quantity of fertilizers on their soil due to lack of awareness.

- *Improper proportion of pesticide*

There is no awareness among rural farmer about proportion & selection of pesticide for pest control which turns productivity of crop bound to below.

- *Absence of Crop Rotation*

Proper rotation of crops is necessary for successful agricultural as it helps to maintain the soil fertility. As the Indian rural farmers are mostly illiterate, they are not very much aware about the benefits of crop rotation due to which the soil loses its fertility.

- *Agricultural Indebtedness*

Farmers are losing their productivity every year arising from low prices of crops. The rural people are borrowing heavy amounts of loans regularly for meeting their requirements needed for production.

- *Use of technology is inadequate*

Adoption of modern agricultural practices and use of latest technology is inadequate, In India; farming practices are non-scientific and need some forethought before implementing any new technology. The screening of technology is important since all innovations are not relevant or attractive to all areas. It is important to screen them according to the geographical area and the local context of agriculture and appropriate technologies need to be adopted [13].

4. EXPERT SYSTEM APPROACH IN AGRICULTURE

This technology is a kind of advanced communication techniques that combines the fault diagnosis technology and computer communication technology to overcome the problems faced by the agriculture sector in INDIA. To support the efforts of farmers, decision makers and other subjects in agriculture and rural areas to quick and successful adapt on continuously changing production, environmental and socio-economical conditions, steadily new plans and their variations have to be designed and afterwards checked to realize, if selected adaptation measures are going to be successful or at least feasible. One of the tools that can be used to support this tasks, are the decision supports systems. Based on internet and artificial intelligence (AI) techniques to build Web-Based Remotely Accessible Expert System-Enabled Information Centre for Rural Former, can provide expert-level advice and diagnosis services to help optimize the crop production for rural Farmer particularly in India.

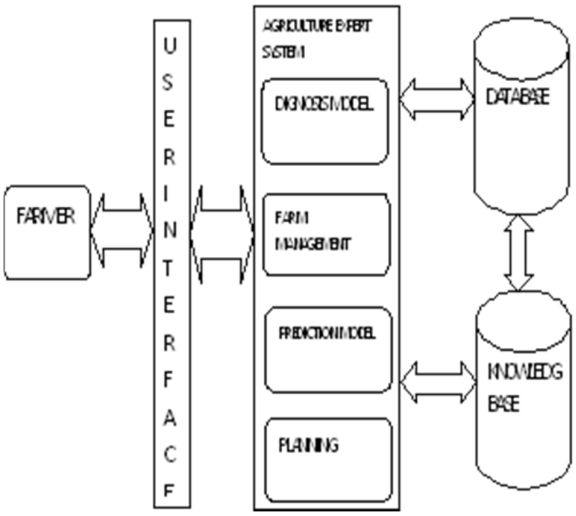

Figure.2 Conceptual Expert System Approach to Agriculture

- *Farmer*

The user of the system who is going to interact with Expert System (ES), by querying the identified problem or current condition to get suggestion or solution over it. The Farmer can write query by typing through keyboard, interacting by audio visual GUI and system can respond by displaying it on screen.

- *User Interface*

It is user friendly interface for Farmer to interact with system on the screen.

- *Agriculture Expert System (AES)*

The body of System managed by Knowledge Engineer where all Expertise Knowledge base are built as a algorithms and program logic in respect to process the query and extract the related expertise from knowledge base.

- *Database and Knowledge Base*

The systems where all data and Expertise are reside and connected with the system to provide the required data.

5. BENEFITS TO THE FARMER USING EXPERT SYSTEM

- *Diagnosis of crop disease*

Farmers can diagnose their crops diseases using expert system so they need not to visit pest control specialist and they could save time and money

- *Irrigation schedule*

They can manage irrigation for their farm which required different on variety of crops, so they can plan for irrigation.

- *Selecting proper pest control*

By observing crop disease symptoms they can select proper pesticide for their disease which will increase productivity.

- *Selecting fertilizer and their quantity*

Depending on soil nutrient condition they can select proper fertilizer and their quantity for their crop.

VI. SOME AGRICULTURE EXPERT SYSTEMS

- *Rice-Crop Doctor*

National Institute of Agricultural Extension Management has constructed an expert system to diagnose diseases for rice crop and suggest preventive measures [5].

- *AGREX*

Center for Informatics Research and Advancement, Kerala has developed an Expert System called AGREX to help the farmer by giving timely and correct advice to the farmers. This Expert System useful for fertilizer application, Irrigation scheduling, and diagnosis of diseases on Rice crop [5].

- *Farm Advisory System*

Punjab Agricultural University, Ludhiana, has developed the Farm Advisory System to support agriculture. The conversation between the system and the user is like the system asks all the questions from user one by one which it needs to give suggestion on the topic of farm Management [5].

- *VARIEX*

This expert system developed at Technical University of Brno, Czechoslovakia enables selection of the best cultivators for different agricultural situations [5].

6. CONCLUSION

This paper has discussed the usefulness and need of expert systems in rural agriculture and availability of various expert systems. The need of expert systems for technical information transfer in agriculture can be identified by identifying the problems. The benefit of an expert system is that it can offer better than traditional method. It is proven that expert systems in agriculture helps a lot in increasing the crop production. But almost all the expert systems are in English language. By building an expert system of agriculture in a mother tongue of a farmer, it helps him/her to increasing the production.

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