

Analysis of ‘Expert Irrigator’ Developed for Sugarcane Irrigation Scheduling

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Abstract—Expert systems have been applied increasingly for agricultural fields in recent years for solving most of the problems. ‘Expert Irrigator’ is an expert system developed for sugarcane irrigation scheduling and thereby minimizing irrigation problems of Kolhapur division. Analysis is very important stage of any software development life cycle. The paper focuses on analysis details of Expert Irrigator.

Keywords— Expert System, Irrigation Scheduling, Sugarcane Irrigation Problems, Kolhapur Division

I. INTRODUCTION

In Sugarcane is major cash crop of India and Maharashtra is India’s second largest sugar-producing state. Kolhapur division holds a leading rank in respect of sugarcane cultivation and sugar industry. The production capacity can be increased more than this by solving sugarcane irrigation problems of this area. Sugarcane is water sensitive crop. The water resources are scarce. At present, farmers irrigate the land at the regular intervals based on general judgement. Plant water requirement depends upon various irrigation parameters such as humidity, temperature, soil type etc. As Farmers could not get exact water requirement of sugarcane, problems such as soil salinity, erosion etc arise. They also could not use available water efficiently and hence cannot get sufficient water for irrigation. All such irrigation problems can be rectified with accumulation and integration of knowledge and information from many diverse sources into a knowledge base and build an expert system. Expert Irrigator is an expert system which can be used to decide amount and interval of irrigation of sugarcane. Analysis is the problem identification phase where knowledge engineer finds out important features of the problem with the help of domain expert. Agricultural expert systems require special approaches to systems analysis; especially to the collection of the data or rather knowledge on which the system is based. The paper focuses on analysis details of Expert Irrigator.

II. DEVELOPMENT PHASES

The Expert system is also a computer system which is developed with a planned software development life cycle. But there are various distinctive features between usual software and expert system and hence the SDLC model is

usually selected according to development objectives and activities in each phase. Life cycle of Expert Irrigator consists of 6 phases viz. Analysis, Conceptualization, Designing, Coding and Testing, Deployment and Post Deployment Analysis.

This paper only considers analysis aspects of ‘Expert Irrigator’. Hence all sub activities followed in the analysis phase of development is discussed in detail in the paper.

III. ANALYSIS

To find the sugarcane irrigation problems researcher has carried out a detail survey of Kolhapur division which consists of three districts viz. Sangli, Satara and Kolhapur. She selected 386 farmers from study area based on sugarcane cultivation land to get experimental data. Experiential data of 33 experts from same area is also collected. Researcher has found 6 major problems. These problems are as follows:

- Farmers cannot get exact water requirement for sugarcane
- Farmers cannot get sufficient water for irrigation
- Some of them cannot get water as and when required because of common irrigation schemes
- Farmers cannot implement new automation tools because of common irrigation schemes
- There is no proper irrigation management for sugarcane
- Farmers cannot get electricity regularly for irrigation

A. Need Assessment:

Researcher assessed the need of expert system to solve analysed problems. Among selected experts, 90.30 % agree the fact that expert system can be helpful to solve sugarcane irrigation problems and it facilitates drip irrigation more effectively while 79.5 % farmers are willing to use expert system for irrigation in Kolhapur division. Available irrigation sources of Kolhapur division can be managed and used efficiently using expert system application to increase sugarcane production more than this.

B. Objectives:

Following are some of the objectives or goals of expert system development

- To provide a system for proper sugarcane irrigation management which ultimately gives the solutions to solve analysed irrigation problems
- To develop a system that provides expert-like-suggestions for efficient irrigation scheduling
- To come out with a portable, reliable, feasible, cost effective and farmer friendly system

C. Scope:

The scope of the system has been decided according to functional scope of the research. The system is designed by taking various analysed sugarcane irrigation problems into consideration. Hence the scope of the expert system is limited to functionalities which can be used for effective sugarcane irrigation management. Hence it is customised expert system which considers major irrigation related aspects of Kolhapur division. The system can be viewed with two perspectives viz. farmer and expert. These users can use the system to generate irrigation scheduling charts based on selected parameters. Experts can also manage all master information of the system.

D. Setting Functionalities:

At this stage the analysed problems discussed above has been converted into system requirements. Following are some of the system requirements:

- Expert system should provide all necessary help for sugarcane irrigation scheduling.
- The expert system should consider all irrigation parameters and correct scheduling method.
- The knowledge base designed should consider the experiential knowledge of field experts and experimental knowledge of farmers.
- The usable output should be produced with minimal input.
- All input and output screens should be easily understandable to end user which is farmer in this case.
- The output should be easy to implement for a given sugarcane field.
- The schedule should be stored at some location for future reference.
- The system should be cost effective, portable, convenient, reliable and easy to use.
- It should be easy to install and update.
- It should provide help at each stage.

In summary the system should provide all necessary help as expert of sugarcane irrigation and should have all necessary functionalities which are required to solve sugarcane irrigation problems. Also it should be economically, technically and operationally feasible.

E. System Feasibility:

Before developing the expert system, it is needed to identify how, where and for whom it is being developed. As discussed earlier this system is for farmers and hence researcher being a developer has checked for 3 types of system feasibility tests in analysis phase itself. It was thus carried out to identify potential problems and to answer the question whether this solution to irrigation problem would work.

1) *Technical Feasibility*: All the components of the system were designed using available software with expert system development skills of researcher. The knowledge base was generated using experimental knowledge of farmers and experiential knowledge of experts. Hence the system is technically feasible.

2) *Economical Feasibility*: Almost 82 % experts agree that farmers cannot implement expert system due to poor socio-economic condition (Ref. Table No. 4.40) and hence the system was designed in such a way that it can be implemented with minimal requirements of software and hardware. Hence it is economically feasible to the end user.

3) *Operational Feasibility*: User interfaces for expert systems are more troublesome, and harder to develop, than those of conventional pieces of software. This is because the interactions between computer and user are more complex than those involved in a conventional piece of software. The end user of the system is a farmer and most of the experts (84 %) are of opinion that Expert System cannot be implemented due to lack of literacy and awareness of farmers (Ref. Table No. 4.40). Therefore the expert system was designed by considering farmers at centre place. The system produces usable output with minimal input and all input-output screens are easily understandable to them. The output produced with given parameters is easy to implement for a sugarcane field. Hence the system is considered as operationally feasible.

After successful conduct of this study researcher decided to go for development of expert system for sugarcane irrigation problems of Kolhapur division.

IV. CONCLUSION

Expert irrigator is an expert system designed and implemented by considering systematic approach of expert system development to solve some of the irrigation problems faced by farmers in Kolhapur Division. All the activities of the first step of system development life cycle i.e. analysis, has carried out with great care by the developer. This made whole development process effective and final product i.e. 'Expert Irrigator' very useful for irrigation scheduling of sugarcane. Hence it will definitely assist the farmer to take irrigation related decisions like a human expert.

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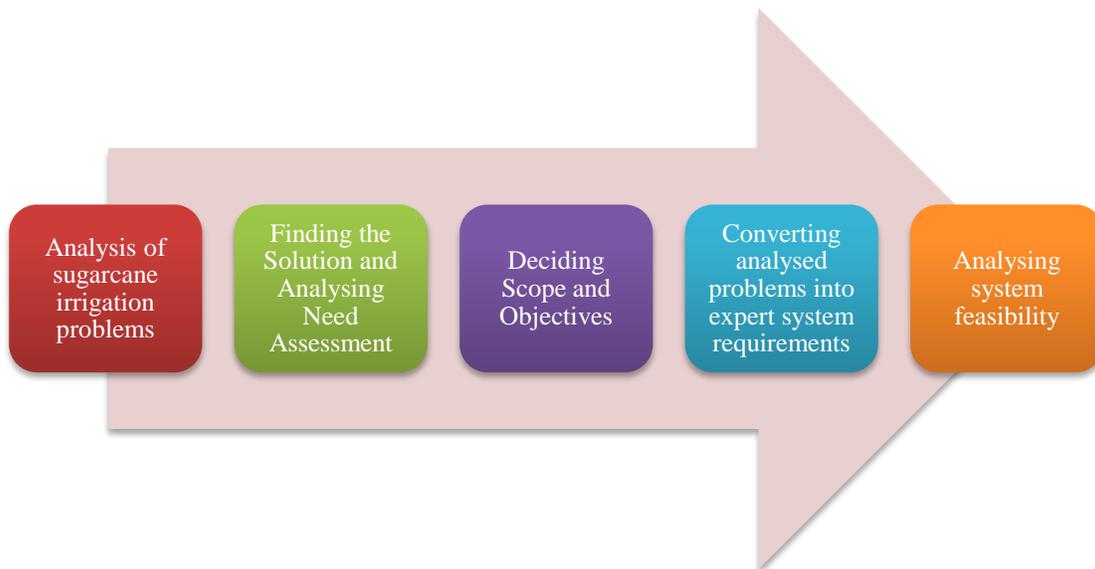


Fig. 1: Analysis activities carried out for Expert Irrigator development