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Providing revolution with Decision Support System in Field of Agriculture

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Abstract: ***Decision support systems (DSS) is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge, or business models to identify and solve problems and make decisions. It includes models and databases and they are used in decision making. It has been applied to solve variety of agricultural problems. It provides the framework that allows both the decision-makers and farmers to make good decisions. Decision support systems (DSS) use databases, human– machine to combine a large number of models to realize scientific decision-making. The environmental data plays a vital role in agriculture decision, which changes at a rapid rate. Keeping these data updated can be done by using a Service Oriented Approach (SOA). At present, irrigation decision-making systems applied to the field of agriculture were mostly aimed at a given area and specific crops. In this paper, a precision irrigation decision-making system has done something to solve this problem. This paper presents that SOA used to get precise irrigation schedule for different crops. One of the basic business motivations for implementing SOA today is achieving business agility, can help businesses respond more quickly and cost effectively to the dynamic and continues changes in market conditions.***

Keywords: Decision Support System (DSS), Service Oriented Approach (SOA), Decision Making, Irrigation.

I. INTRODUCTION

Decision support system (DSS) uses databases, human–machine to combine a large number of models realizes scientific decision making. The decision support systems are present in many fields and aim to help the decision maker in his task by providing him all the relevant elements for decision making. Decision support system (DSS) is a computer-based information system that supports business or organizational decision making activities.

DSSs include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge, or business models to identify and solve problems and make decisions. Three fundamental components of a DSS architecture are:

- The database (or knowledge base)
- The model (i.e., the decision context and user criteria)
- The user interface.

The users themselves are also important components of the architecture. The decision support systems are present in many fields and aim to help the decision maker in his task by providing him all the relevant elements for decision making. There are several problems related to agriculture like crop management, inadequate use of manures and fertilizers, inadequate water supply, quality of seeds, etc. But water scarcity and competition is the main issue in developing countries as far as water resources development and management is concerned. The per capita availability of water is decreasing day by day due to population growth. The demand for water is rising for increased food production, further industrial development, better standards of living, etc. Due to the scarcity of water, and the attention of decision makers to the optimum use of the water this leads to maximize the benefit. [13] Decision support systems in irrigation management applications began in the early 1990s [1]. Management of irrigation is one of the most important aspects of cultivation production. Farmers do not have the needed information to minimize water usage without reducing plant productivity.

The goal of the work described here is to optimize crop water usage by using SOA technology. This goal can be achieved by helping framers to irrigate their crops by the exact needed amount of water at the exact needed time to their environments. The work presents a generic design for irrigation expert system for trees which provides the farmers by the irrigation expertise to determine the exact water needed at exact time according to their environments.

II. Related Work

Ayman Nada, Mona Nasr and Marwa Salah in [1]have discussed a technique for irrigation decision-making systems applied in agriculture which is useful for given area and specific crops; it is difficult to be applied in different areas and different crops. In addition, the system is mostly based on networks and results are shown in the form of a web. Business handling logic and decision-making logic are often solidified in code, various processes closely coupled. DSS consists of five components model are Data Management DMS, Model Management MMS, Knowledge-based Management KB, User Interface - Graphical User Interface (GUI), and The User which consider a decision makers or manager as in. The data management system DMS performs the function of storing and maintaining the information that you want DSS to use.

J. Cheng, K. Law, H. Bjornsson, A. Jones, and R. Sriram [3] discussed that Irrigation water is the most limiting and most precious resource of agriculture today. Managing irrigation precisely is one of our most urgent challenges [3]. Too little water, even for a short time, can damage a crop, reduce yield and quality, and destroy a farmer's income. Too much water is expensive, wasteful, and raises environmental concerns raise the rate of groundwater and surface water that destroys farmland. Recently many researchers interested in studying DSS and the integration between Service Oriented Architecture (SOA) and DSS in agricultural domain and others.

B.Venkatalakshmi and P.Devi[15], worked on Decision Support System For Precision Agriculture. The proposed architecture in this paper has been implemented using Decision Support software called Netica. This software has an intuitive and smooth user interface. This tool makes use of Bayes networks for the development of any complex decision support systems.

III. Proposed Work

SOA enable proposed architecture to the aspects: flexibility, performance and efficiency are directly effects on the quality of service. SOA have well-designed services in order to gain the predicted benefits, like flexible business processes and low development costs. This work proposed a system to optimize crop water usage by using SOA technology. This system can be proved helpful for farmers to irrigate their crops. It will be applied in agriculture which is useful for different areas and different crops. The work presents a generic design for irrigation expert system for trees which provides the farmers by the irrigation expertise to determine the exact water needed at exact time according to their environment. To obtain the goal, DSS architecture is based on SOA. Although individual service efficiency is high, but from the business sense, completing a business task

requires more service calls, like calculation of irrigation schedule, so the corresponding times of requesting and responding will increase. Following is the use case diagram of the proposed system.

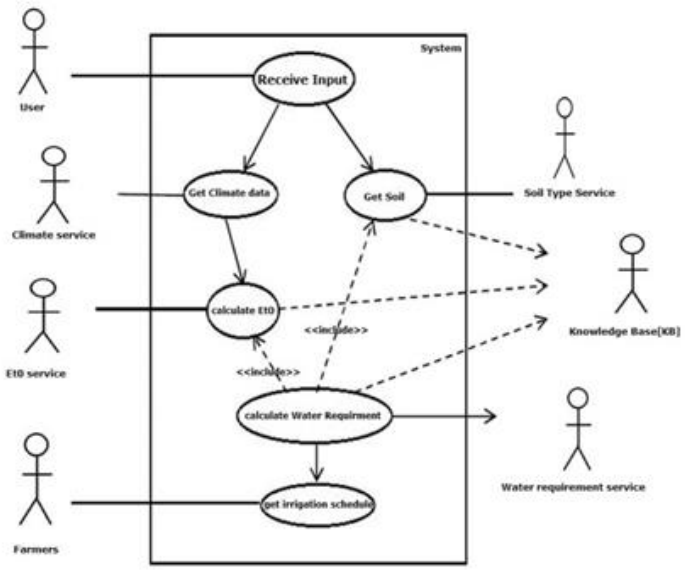

Fig. 1 Use case diagram of proposed system

It will obtain soil information on the basis of certain parameters and provide real time information about irrigation schedule. It also provides cropping plant, requisite fertilizers on the basis of current natural situation to farmers. To generic design DSS model components using SOA that:

A. Data Management System: The DMS component includes the irrigation model task which manages all the system components.

B. Model Management System: The Model Management System is executed by using SOA. SOA have well-designed services in order to gain the predicted benefits, like flexible business processes and low development costs. The business logic is more complex and need more functions that effects on increasing service size.

USER FLOW

Step 1: user/farmer can registered to the application using user registration link.

Step 2: After login, user/farmer can edit their own profile.

Step 3: For Water requirement calculation user have to select crop from database.

Step 4: Then the result shows the current temperature, soil type required for crop, required season & water required for that crop in user interface by using knowledge based & database management decision support system.

Step 5: If the user/farmer have the problem other than water requirement, the query can send to the admin

Step 6: After checking query, admin gives response to it by using their knowledge based system

Step 7: User can check the previous year's rainfall record by using databased system used in the DSS.

ADMIN FLOW:

Step 1: Using admin login page, admin can login to their account using username and password.

Step 2: Admin has authority to add new farmers using their basic information and also check the list of already registered user/farmer.

Step 3: Next step is to check the query sends by the farmer reguarding to their agricultural issuses and give the response to solve their problems. For this admin use knowledge bbbased decision support system.

Step 4: Check the soil sample and compare it with the existing soil sample database by using data management system for DSS.

Step 5: Check crop details by using existing database of crops.

Step 6: Admin can also check the weather of particular location of user.

IV. PERFORMANCE MEASURES

Performance measure of the proposed approach and the simple DSS is done based on Precision measure. Precision is the basic measure used in evaluating search strategies. There is a set of records in the database which is relevant to the search. It is the ratio of number of relevant records retrieved to the total number of irrelevant and relevant records retrieved. It is usually expressed as percentage.

Precision measure is calculated based on the following formula.

$$\text{Precision} = \frac{tp}{tp + fp}$$

Where,

tp – True Positive (Correct decision)

fp – False Positive (Unexpected decision)

Performance of the system

Different Methods	tp	fp	Precision
Existing simple DSS	2	8	0.2
Proposed Agriculture based DSS	9	0	1

Table 1: Precision Measure

From the table 1, it is understood that precision of the Existing simple DSS is 0.2 and the precision of Proposed Agriculture based DSS is 1 out of 1. The results of the performance measure are plotted in Figure 3.

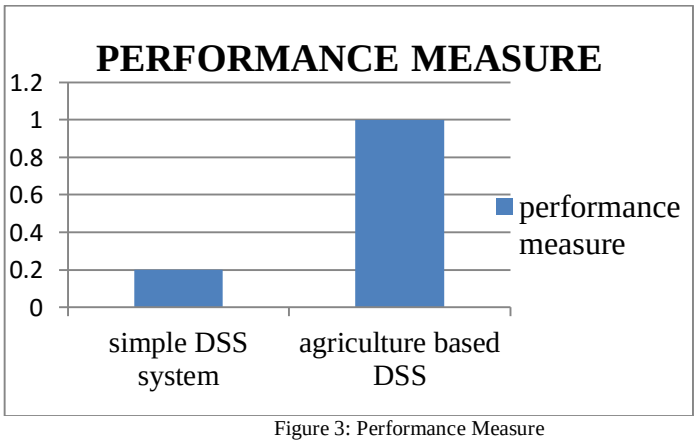

Figure 3: Performance Measure

V. CONCLUSION

The system will be used to build a decision-making model for irrigation for different users. This is focused only on services and the system assembly model, which leads to a good reflection, wide usability and save time. The goal of this irrigation

system is to determine the exact amount of needed water and the exact timing for applying it. The amount of water required will be determined dependent on each user situation.

VI. Future Scope

Modern agriculture offer a range of benefits including greater production and higher income for farmers in both developed and developing countries for e.g. using a web application for take a decision in water requirement calculation and other problems regarding to the agriculture so that increase a production of field in available environmental situation. Farmer empowerment can be successfully achieved by providing them right information at right time. Informed decision making by effectively utilizing the different new technology and different agriculture model tools will increase productivity. This will not only motivate the farmers in the rural area, but also drive urban youth towards hi-tech farming.

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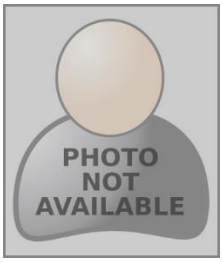

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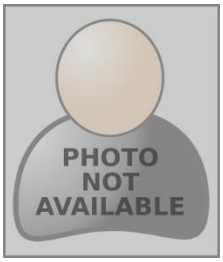

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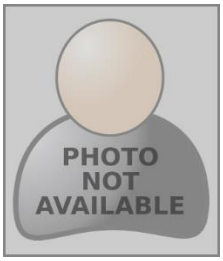

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