

Farm Advisory System for Farmers of Northeastern states of India

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Abstract- Agriculture means jobs and income for Northeast states of India. Rice is the most important food crop. However, the rice production in this region is still below the all India average rice productivity [Anonymous, 2000]. This could be attributed to traditional cultivation methods that might not always result in good yield, unavailability of experts and non-optimum utilization of tools and techniques. The currently available agricultural services have a few limitations. The information dissemination follows a push model which fails to share information at the right time and with the right group of farmers that may get impacted otherwise. Farmers require timely, accurate and location specific information in relation with different aspects of farming like the pests, diseases, weeds and fertilizer management, etc. for their crops from agricultural experts. On the other side, the complexity of a whole farming process is growing because it is constrained by many factors such as requirements, goals, regulations, etc. that farmer must satisfy or consider. To provide such information and to achieve an optimal crop plan, the automation is provided by computer-based systems termed as Advisory Systems. An advisory system supports the farmers in getting expert advices on many activities in a farming process. With this system, farmers can access virtual agricultural experts as and whenever needed.

Keywords – Agriculture, Farmer, Case Based Reasoning, Intelligent Advisory System

I. INTRODUCTION

Agriculture is always been INDIA'S most important economic sector. From a nation dependent on food imports to feed its population, India today is not only self-sufficient in food production, but also has a substantial reserve. Agriculture and allied activities constitute the single largest contributor to the Gross Domestic Product (GDP), almost 33% of it. This increase in agricultural production has been brought about by bringing additional area under cultivation, extension of irrigation facilities, the use of improved high yielding variety of seeds, better machinery tools and techniques evolved through agricultural research, water management, and plant protection through judicious use of fertilizers, weather conditions, soil moisture evolved through agriculture field sensors, pesticides and cropping practices.

However, Indian agriculture is still facing a multitude of problems to maximize productivity. Due to several reasons, the majority of the farming community is not getting upper bound yield despite successful research on new agricultural practices like inventing new crop varieties, crop cultivation, weed control and pest control techniques. One of the reason is the use of natural resources for agriculture in India also gradually decreasing, and using of pesticides is increasing (expensive in cost), so no of farmers also gradually decreasing because of economic loss in the agriculture. The second reason is the present Agricultural Extension Services employed which follows traditional information dissemination which fails to share information where and when needed, or are constrained by time slots, etc (committing human experts). Farmers, who do not have direct access to scientific knowledge about farming often relies on peers for the same and hence, may get incomplete and/or distorted information. Furthermore, the complexity of a whole farming process is growing because it is constrained by many factors such as requirements, goals, regulations, etc. that farmer must satisfy or consider [Jose Lopez-Collado, 1999]. Thus, manual evaluation of all the possible combinations of factors that affects the farm planning is impractical and prone to errors.

Because of these complexities involved to achieve an optimal crop plan, computer-based systems such as Advisory System is required to automate many activities like pest control, disease control, weed control, crop variety selection, crop rotation, weather monitoring, irrigation scheduling, seed cleaning, soil conditions etc. in a planning process. An Advisory System for farmers provides expert advices to farmers on many activities in a farming process, also used as material for students in universities. With this system, farmers can access virtual agricultural experts as and when needed.

On the other hand, developing such an advisory system for farmers is not so easy. The applicability of such a system across different regions may not be possible. The farming process and techniques may be varied from region to region. Depending on the geographical and atmospheric difference, the type of crop to be planted may be varied among regions. In addition, some farmers may prefer to their local varieties of crop. Thus developing such an

advisory system for farmers needs deep knowledge of the agriculture domain and huge knowledge acquisition from mainly experts and farmers. Example, Cha-hao(black rice), a special paddy type, is a local rice variety grown in Manipur. The technique and farming process for Cha-hao is different from other paddy variety. These farming process and techniques might not be aware by experts and farmers living in other parts of India.

The farmers from Northeastern states of India face a lot of challenges for enhancing their production and getting timely remedial information of their crops from agricultural experts. In this paper we present an advisory system for major crops like rice, maize, turmeric, ginger, cabbage, tomato, potato, etc. in different fields and how an advisory system can be used to address these challenges. Section 2, describes problems facing by farmers from Northeastern states of India. Section 3, present the need of Advisory Systems in agriculture. Intelligent Advisory System for Farmers (IASF) is described in Section 4. The conclusion is discussed in section 5.

II. PROBLEMS FACING BY FARMERS OF NORTH-EASTERN STATES OF INDIA

The major extension services related problems facing these farmers that are the lifeline of the society and who also responsible to fulfil his family needs are the followings:

A. *Unavailability of Experts –*

Farmers rely heavily on field agriculture extension agents or officials of the Department of Agriculture for crop diagnostic and advisory services, whenever faced with the dilemma on how to fend off attacks by insect pests and diseases on their crops; which if left uncontrolled, can lead to severe economic loss and render the resource poor farmer, debt ridden. Farmers face problems frequently when they need help from agricultural experts in critical times where access to an agricultural expert is not forthcoming or due to unavailability of agriculture extension worker in the field.

B. *Lack of Access to Timely Advice –*

In most instances, farmers living in remote geographical areas of North East India, without road connectivity, need to walk for hours to reach the nearest CD Block office to get help. Getting correct diagnosis and timely advice from crop and disease experts is of vital importance in order to take timely corrective measures to save their crops.

C. *Access/Nonadoption of New Agricultural Technologies –*

Despite the technology advances in agriculture, most technologies do not reach to the farmers of Northeastern states of India, as they receive no information about them. Most rural farmers are illiterate and do not adopt new technology because they lack knowledge and they preferred traditional methods. Most rural farmers also do not trust automatic advisories generated by new technologies. Future growth must come from timely advisories of improved farming techniques and better remedial and agronomic practices. Farmers' lack of involvement into new technologies and its implementation has resulted in having a reversed effect on their work load of providing them with the expected yield.

III. INTELLIGENT ADVISORY SYSTEMS IN AGRICULTURE

The Farm Advisory System aims at helping farmers to better understand and meet more yield of their product. Intelligent advisory systems (IASs) are computer programs that use the techniques of artificial intelligence to mimic human expertise that uses knowledge and inference procedures to solve problems those are difficult enough to require significant human expertise for their solution. Intelligent Advisory System is used world wide to address problems of farmers where decision making is very complex and risky and those activities which required agricultural experts such as: selection of land; selection of crop; crop rotation; irrigation scheduling; weed and pest control; prognosis, diagnosis and treatment disease; marketing of crops; method of planting; etc. Example systems are CRACTOR: [Prabhakar V.V.Bhogaraju, 1996], CARMA[John D. Hastings, L. Karl Branting, Brandon M. Hauff, 2002], Fish Disease Case Reasoning System, A hybrid case based reasoning approach for monitoring water quality[Dongmei Lou, Ming Chen, Jiechao Ye, 2007]. POMME is an expert system for apple orchid management [G.N.R. Prasad, Dr. A. Vinaya Babu, 2006]. CALEX is an agriculture management system. [G.N.R. Prasad, Dr. A. Vinaya Babu, 2006]

CRACTOR is an advisory system which can recommend a crop rotation plan which required considering many factors such as farmer's goals and preferences, soil erosion risks, pesticide pollution risks, and economic assessments when generating management plans. CARMA is an advisory system to help ranchers to determine the most cost effective responses to rangeland grasshopper infestation within user-defined environmental constraints. CARMA has been endorsed and advocated for use by pest managers by the United States National Grasshopper Management Board(NGMB, 2001).

IV. DESCRIPTION OF IASF SYSTEM

Intelligent Advisory System for Farmers (IASF) is an advisory system, a CBR based advisory system, for answering queries related to farming activities carried out in Northeastern states of India. The system can be extended with inclusion of any other crops from any State of India. IASF is implemented for five major farming activities (Insect Management, Disease Management, Weed Management, Rice Variety Selection and Fertilizer Management) which required expert's advice relating to diagnostic and remedial measures. IASF has been covered ten crops (Paddy, Potato, Tomato, Cabbage, Brinjal, Chilli, Cucumber, Green Pea, Mustard and Ginger) and it is extended to three local languages Manipuri, Khasi, and Garo.

IASF aims to improve and strengthen the reachability of the existing agricultural services by integrating Information Technology (IT) with the mobile services. This service captures each of the queries of the farmers in a database along with its relevant and correct solution suggested by the agricultural experts (termed as a 'CASE'). Whenever a farmer asks a query related to any of the farming activities supported by IASF, the computer system automatically produces a highly probable solution from the large database of CASES containing corresponding experts' opinions/advice, given by a team of agricultural experts and subject matter specialists. If the CASE is unique in nature, then the system refers this CASE to an agricultural expert or KVK Scientist connected by IASF, for providing the specific remedial solution via email and SMS. The expert in turn can answer back by simply sending an SMS from his registered mobile number to 51969 or by logging-in to his expert's account in the IASF portal. A farmer who does not have access to Internet can simply raise a query by sending an SMS in a specific format to 51969 and get the advice from an expert on his mobile by the return SMS.

The system can help farmers in critical times where access to an agricultural expert is not forthcoming due to the unavailability of agriculture extension worker in the area. The system is especially useful in the states and the rural areas where the ratio of extension workers to the farmers is a small number and where the access to such experts is not feasible.

IASF system is monitored and evaluated by sixty experienced local Subject Matter Specialists. IASF uses two layers of validation of the system generated advisories, automatic validation and manual validation by local agricultural experts who are popular to the farmers. IASF inform local experts via mobile SMS whenever there is information exchange between IASF and farmers. It gives trust and confidence to farmers that they feel indirect interaction with agricultural expert with help of automated advisory system.

IASF has proved beneficial to more than 2500 registered farmers in states of Meghalaya and Manipur who use the platform for redressal of their farm problems. More than 50 registered Subject Matter Specialists have shown their active responsibility by answering to more than 1700 farmers' queries in real time. This project provides PUSH and PULL mobile services for farmers. Farmers can get various useful information from IASF portal via SMS by sending in a specified format to 51969.

This project is highly scalable and easily deployable with localised content in the native languages of any state of North East India in a very short span of time. This is the first of its kind project in North East India, where ICT has come to the rescue of resource-poor farmers residing in remote parts of the country that have high difficulty to access. The integration of web technology and mobile service delivery gateway has further raised the usability of IASF so much that the reachability of the services in terms of the distance as well as the volume of users can be expanded exponentially aligning them with the rapidly growing mobile connectivity of the region.

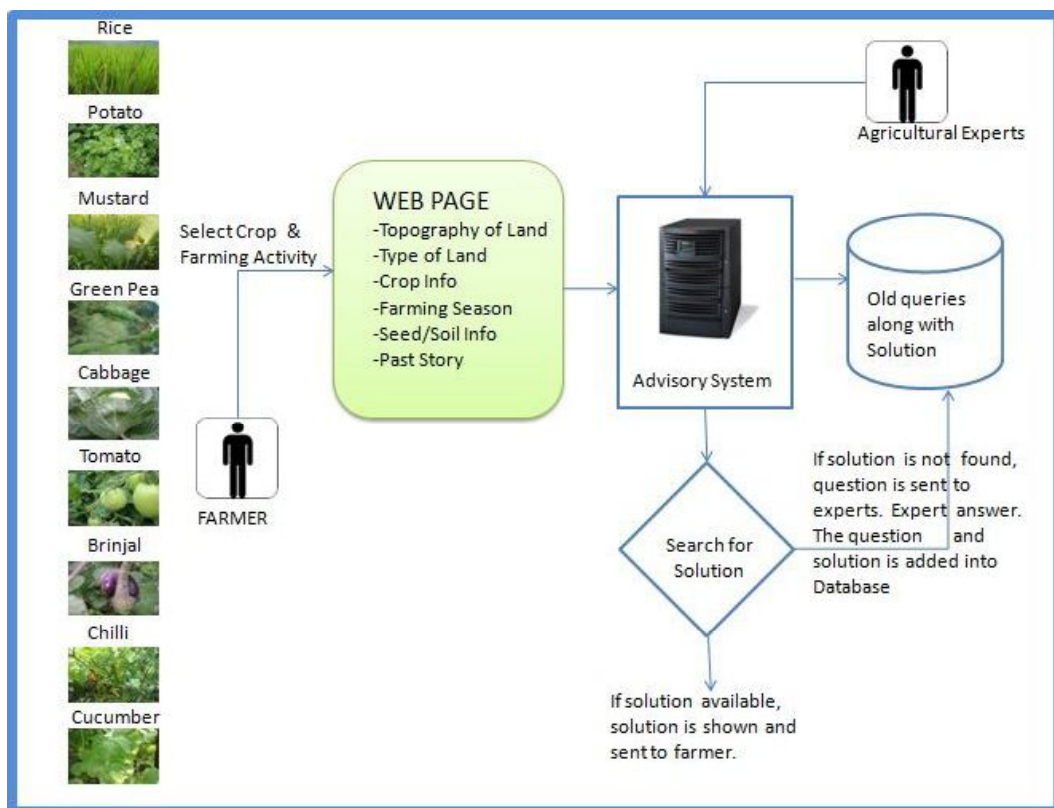


Figure 1. Structure of Intelligent Advisory System for Farmers

V. CONCLUSION

Agriculture means jobs and income for Northeast states of India. Utilization of new tools and techniques could increase agricultural production. Unfortunately, farmers from this region have not given attention to the new technology and tools by unchanging their tradition way of cultivation. Advisory System is a useful farming tool which can increase yield because farming activities in a farming process is a complex problems involving imprecision, uncertainty and vagueness. On the other side, agricultural extension services can be improved using such advisory system which creates a virtual interaction between farmers and experts. Through IASF, farmers from this region will able to connect indirectly with agricultural experts through mobile SMS and Internet from anywhere. It is expected farmers will able to get help in critical times where access to an agricultural expert is not forthcoming or due to unavailability of agriculture extension worker in the field. The system will be specially useful in States and rural areas where the ratio of extension worker to farmer is very wide.

REFERENCES

- [1] Basic statistics of North Eastern Region, North Eastern Council, Ministry of Home Affairs, Govt. of India, Shillong, 2000.
- [2] Embassy of India, <http://www.indianembassy.org/dydemo/agriculture.htm>.
- [3] India Agriculture, Agriculture in India, http://www.indianchild.com/india_agriculture.htm.
- [4] Dongmei Lou, Ming Chen and Jiechao Ye, "Study on a Fish disease case reasoning system based on image retrieval", *Journal of Agricultural Research*, Vol. 50(5), pp 887-893, 2007.
- [5] G.N.R. Prasad and Dr. A. Vinaya Babu, "A Study on Various Expert Systems in Agriculture", *Georgian Electronic Scientific Journal: Computer Science and Telecommunications*, Vol. 5(4), pp 81-86, 2006.
- [6] J. Panduranga Rao, "EXPERT SYSTEMS IN AGRICULTURE", <http://www.manage.gov.in/managelib/faculty/PanduRanga.htm>
- [7] John D. Hastings, L. Karl Branting and Brandon M. Hauff, "CARMA: A Case-Based Range Management Advisor", in *Proceedings of the 13th Innovative Applications of Artificial Intelligence*, AAAI Press, Menlo Park, CA, 2001.
- [8] Jose Lopez-Collado, "A Whole-Farm Planning Decision Support System for Preventive Integrated Pest Management and Nonpoint Source Pollution Control", Dissertation, Virginia Polytechnic Institute and State University, 1999.

- [9] Prabhakar V.V.Bhogaraju, "A Case-Based Reasoner for Evaluating Crop Rotations in Whole Farm Planning", MSc thesis, Virginia Polytechnic Institute and State University, 1996.
- [10] Reddy, P. K. and Ramaraju, G. V., "E-Sagu: an IT based personalized agricultural extension system", *5th International conference of the Asian Federation for Information Technology in Agriculture*, IIS, Bangalore, pp 99-102, 2006.