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RESEARCH ARTICLE

A RESEARCH PAPER ON REVIEW AND DESIGN OF EXPERT SYSTEMS FOR PEST MANAGEMENT IN AGRICULTURE AREA

Mr. Nripesh Kumar Nrip and *Dr. Anil T. Gaikwad

Department of Computer Application, BVDU Institute of Management, Kolhapur, Maharashtra-416003, India

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ABSTRACT

This study aimed to identify the motivational and demotivation factors and of public and private employees from the city of João Pessoa – Paraíba - Brazil. It was developed with a sample of 201 participants, in which 121 were private servers and 80 public servers. The instruments used for data collection were: Motivation Multifactor Scale at Work, complementary issues related to work motivation and the socio-demographic questionnaire. The results showed no differences between the two sectors regarding questions of stability and recognition at work. As for the factors that motivated and demotivate at work, compensation was the most cited by both sectors, followed by other relevant, as recognition and growth opportunity. In addition, employees from public sector indicated a greater motivation to work over the private. In short, it is considered that this study may contribute to the development of motivational policies that take into account the particularities of each sector and to each employee.

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INTRODUCTION

Expert System is one of the important application-oriented branch of Artificial Intelligence. The Expert Systems approach attempts to model the domain knowledge of experts in their respective areas of specialization, for example, diagnosis, planning, forecasting etc. Expert System is based on the knowledge including not only models and data, but more emphasizing on experiences of domain experts. An expert system is a computer application that solves complicated problems that would otherwise require extensive human expertise. It can be operated by any one even by a less educated person in a particular field of knowledge

A. Expert system

An Expert System is a computer program designed to simulate the problem-solving behavior of an expert in a narrow domain or discipline. Expert system can be defined as a tool for information generation from knowledge. Information are found in various forms like Text, images, audio and video or can be generated from data and/or knowledge.

An expert System is divided in three parts

Corresponding author: **Dr. Anil T. Gaikwad,**
Department of Computer Application, BVDU Institute of Management, Kolhapur, Maharashtra-416003, India.

i. **User Interface:-** It is the environment where end users interact with the system. The user can rise a query and get Experts advise from the system using appropriate interface.
ii. **Knowledge base:-** It is a collection of rules about the particular domain area. The knowledge base is gathered and collected from facts and information provided by human experts.
ii. **Inference Engine:-** It evaluates and interprets the facts from the knowledge base in order to provide an result. It acts like a search engine, examining the knowledge base contents for data that would match the input user's query.

B. Fuzzy expert system

The Fuzzy set theory and associated logic namely fuzzy logic, was proposed by Lotfi A. Zadeh, a professor at University of California at Berkeley (Zadeh, 1965). According to Chen and Chen, Fuzzy logic is one of the methods of Soft Computing. Soft Computing is a computational method that is tolerant to sub-optimality, impreciseness, vagueness and thus giving quick, simple and sufficient good solutions (Chen and Chen, 1994). Essentially, a fuzzy set is a set whose members may have degrees of membership between 0 and 1, as opposed to classical sets where each element must have either 0 or 1 as the membership degree—if 0, the element is completely outside the set; if 1, the element is completely in the set. A fuzzy expert

system is an expert system, which consists of fuzzification, inference, knowledge base and defuzzification subsystems (as shown in figure 1). The inference module consists of a set of programs that execute procedural component of expert system, knowledge base and passive data structures. Knowledge engineer collects knowledge from domain expert and transfers it into production rules and creates knowledge base. The Fuzzy expert systems use fuzzy logic instead of classical Boolean logic. The collection of membership functions and rules are used for reasoning about data. They are oriented towards numerical processing and handle uncertain or imprecise information.

Design of Fuzzy Expert System for General Purpose

Dual disciplines, like plant pathology, entomology, horticulture and agricultural meteorology, into a framework that best addresses the specific on-site needs of farmers. The need of expert systems for technical information transfer in agriculture can be identified by recognizing the problems in using the traditional system for technical information transfer, and by proving that expert systems can help to overcome the problems addressed, and are feasible to be developed. An expert system can provide the farmers with dynamic information related to their actual situations, taking into

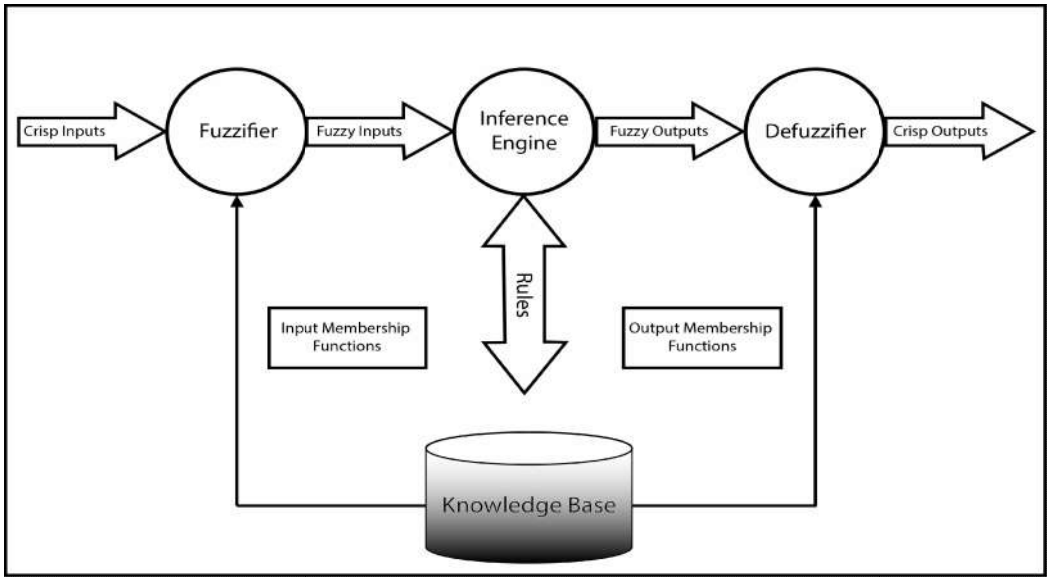

Fig.1. Design of Fuzzy Expert System for General Purpose

During fuzzification the input real values are converted into linguistic values each with a membership function with a range of (0, 1). Fuzzy if-then rules and reasoning are the most important modeling tools which are applied to the terms of the linguistic variables where combinations of conditions lead to conclusions. The rule base is a collection of fuzzy rules forms the fuzzy logic system. Using suitable inference procedure, the conclusion is drawn. This results in one fuzzy subset to be assigned to each output variable for each rule. Again, by using suitable composition procedure, all the fuzzy subsets assigned to each output variable are combined together to form a single fuzzy subset for each output variable. To convert the fuzzy output set to a crisp output defuzzification is applied. The basic fuzzy inference system can take either fuzzy inputs or crisp inputs, but the outputs it produces are always fuzzy sets.

C. Web-based expert system

With the global expansion of the web technology information sharing, Analysis and Decision making become more available, convenient and cost-effective. The wide expansions of web technology, artificial intelligence and expert system can provide information and consultation in interactive and user-friendly approach. More or less, it is open to use by all even by geographically separated users.

II. Expert systems and agriculture

In agriculture, expert systems are used to provide expertise of individ Fig. 01

consideration different specialties and different sources of information, reducing the update time of information in situations where it is centralized and accessible from different locations, and transferring real experience that is not documented in any form of media by gathering it from various experts extension workers and experienced growers.

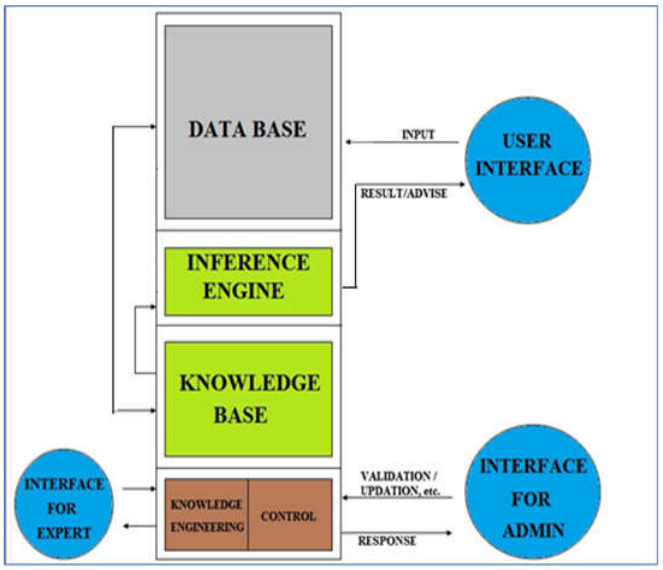

Fig.2. Researcher's Proposed Model for Web based Expert System

Review of various fuzzy expert systems

Harvinder S. Saini, Raj Kamal and A. N. Sharma (2002) proposed and developed a Web based fuzzy expert system for Integrated Pest Management (IPM) in Soyabeans named **SOYPEST**. The system forecasts the development of pest and its activity level. The system also suggests the counter measures for the pest so that its affects can be minimized. The system has been tested by taking feedback from farmers and experts.

Fadzilah Siraj & Nureize Arbaiy (2006), developed an web based expert system named FuzzyXPest for dealing with the forecast of Pest activity from the unstructured information provided by the farmers. The system also deals with the damage level due to development of the Pest in the Paddy crop. The system was verified and appreciated by the by Malaysia Agriculture Research & development Institute (MARDI), Malaysia, Since Rice is most growing crop in Malaysia.

Prasad, R., Ranjan K. R., and Sinha, A. K. (5) formulated an expert system *viz.,* AMRAPALIKA for diagnosing14 different pests including eight diseases and six insects in Indian mango variety. The expert system is developed for important diseases like Powdery mildew, Blackspot, Anthracnose, Red rust, Die back, Bacterial spot, Sooty mould and Malformation and insects like Shoot-borer, Red ants, White ants, Mealy bug, Mites and Fruit fly. This expert system uses logical models of visual symptoms and ailments as the classification rules expressed in the syntax of ESTA. The rule based approach in backward chaining for knowledge representation has been chosen here too. The choice of backward chaining is due to the fact that it is goal directed and resembles the reasoning process of the diagnosis. The next effort is to integrate nutrient deficiency module with this knowledge base.

Virparia (2007) has designed and developed a prototype web based fuzzy expert system for identifying, controlling and monitoring the Groundnut insect pests. The system suggests proper countermeasures based on the symptoms. The system is divided into mainly two parts .The first part is used to identify symptoms on crop to identify the actual problems. The second part recommends appropriate control measure.

Nureize Arbaiy, Azizul Azhar Ramli, Zurinah Suradi, Mustafa Mat Deris (2007) has also developed an expert system to forecast the pest activity in rice crops. The system is able to educate and inform the farmers about pests and their activities in the related crop. Symptom of a pest is captured using questions asked from farmers and accordingly conclusions are made. The System involves fuzzy logic to deal with the natural and uncertain data. The information and knowledge about the pests, treatment control measures and prevention steps are stored in specific knowledge base created in the system.

G. Delgado, V. Aranda, J. Calero, M. Sanchez-Maranon, J. M. Serrano, D. Sanchez and M. A. Vila (2008) developed the first stages of Decision-Support System for providing information on olive growing and also assisting in decision making. The system combines Uncertain data like environmental factor and data from farmers are with other scientific and experimental data. The system is capable to store agricultural and ecological information in fuzzy relational databases. Knowledge Extraction Tools i.e Fuzzy Data-Mining is used for processing and allows rules on expert knowledge related to the domain.

Khan, F. S., Razzaq, S., Irfan, K., Maqbool, F., Farid, A., Illahi, I., and Ulamin, T (2008) established a web-based expert system for wheat crop in Pakistan. He presented a web-based expert system for wheat crop in Pakistan. Wheat is one of the major grain crops in Pakistan. According to the Pakistan Agricultural Research Council (PARC), per capita wheat consumption of the country is 120 kg a year. It is cultivated in vast areas of Punjab followed by Sindh in Pakistan and ranked first as a cereal crop in the country. The rule-based expert system covers two main classes of problems namely diseases and pests, normally encountered in wheat crop. The expert system is constructed using e2gLite™ expert system shell available freely on the internet. This web-based expert system shell allows a JAVA interface to process its input and output sets. The expert system can act as a powerful tool with extensive potential in agriculture especially in situations where agricultural specialist assistance is not readily available when the farmers need it. In Pakistan several diseases are reported to occur (Anonymous, 2000).The important wheat diseases in Pakistan are Black Stem Rust of Wheat, Leaf Rust of Wheat, Bacterial Leaf Blight, Flag Smut of Wheat, Bunt of Wheat, Root Knot and Bacterial Leaf Streak.

Sarma, S. K., Singh, K. R., and Singh, A. (2010) developed an expert system(2010) in order to diagnose and manage the diseases occurring in rice crop. They presented an architectural framework of an expert system in the area of agriculture and describe the design and development of the rule based expert system, using the shell ESTA. The designed system is intended for the diagnosis of common diseases occurring in the rice plant. The rice expert system is a computer program normally composed of a knowledgebase, inference engine and user-interface. This expert system facilitates different components including decision support module with interactive user interfaces for diagnosis on the basis of responses of the users made against the queries related to particular disease symptoms. ESTA programming is based on logic programming approach. The system integrates a structured knowledge base that contains knowledge about symptoms and remedies of diseases in the rice plant appearing during their lifespan. An image database is also integrated with the system for making the decision support more interactive. The pictures related to disease symptoms are stored in the picture database and the intelligent system module prompts these with the interface based on rule based decision making algorithms. The system has been tested with domain dataset and results given by the system have been validated with domain experts.

Babu, M. S. P., Murty, N. V. R., and Narayana, S. V. N. L. (2010) developed a web based tomato crop expert information system in India in 2010. The tomato crop expert advisory system is aimed at a collaborative venture with eminent Agriculture Scientist and experts in the area of tomato plantation with an excellent team of computer engineers, programmers and designers. This expert system contains two main parts viz., tomato information system and tomato crop expert system where in information system, and the user can g*et al*l the static information about different species, diseases including viruses, pests of tomato fruits and plants, their symptoms, preventions and chemical controls. In advisory

system, the user is having an interaction with the expert system online. This rule based expert system validates the symptoms of the tomato crop using the techniques of ID3 Algorithm and some optimization algorithms. This is a web based expert system with java server pages (JSP) as the front end and MySQL as the backend.

Philomine Roseline,Clarence J. M Tauro, N. Ganesan (2012) have developed a wed based fuzzy expert system for integrated disease management in Finger Millets. The system utilizes Fuzzy logic method to frame the rules and defuzzification is applied for finding the severity of the disease. Based on the severity the control and remedial measures are suggested by the system. The system first collects data about symptoms appearing in different parts of the plant and then finds reasons for the disease from the inference engine rules derived from the symptoms.

Robert F. Chevalier, Gerrit Hoogenboom, Ronald W. McClendon, Joel O. Paz (2012) have developed a fuzzy expert system named Georgia's Extreme-weather Neural-network Informed Expert (GENIE) to forecast warning about frost and freeze in horticultural crops in United States. The system incorporates the knowledge of agro meteorology and additional information on air temperature, dew point temperature, and wind speed into a fuzzy expert system.

Conclusion

The main aim of the research paper was to collect the relevant contribution in the field of pest management and design the model of expert system to control the pest falling on crops. The innovative trend of web technology and increasing demand of Expert System has created birth of Web Based Expert Systems. The essence of an expert system is to distribute knowledge into the hands of any non-expert personnel. The fusion of web technology and fuzzy expert system can render thorough information and consultation in interactive and user-friendly approach. All important applications areas of web based expert systems especially in agriculture are clearly described in the paper with the appropriate reference. Thus this paper is very useful for farmers and research students to get detail about relevant topic.

REFERENCES

Babu, M. S. P., Murty, N. V. R., and Narayana, S. V. N. L., 2010, "A web based tomato crop expert information system based on artificial intelligence and machine learning algorithms," *International Journal of Computer Science and Information Technologies,* 1 (1): 6-15.

Chen, C.L. and Chen, W.C. 1994. Fuzzy Controller Design by Using Neural Network Techniques, *IEEE Transactions on Fuzzy Systems*. 2(3), Pages 235-244.

Delgado, G., V. Aranda, J. Calero, M. Sánchez-Marañón, J. M. Serrano, D.Sánchez and M. A. Vila, 2008. "Building a fuzzy logic information network and a decision-support system for olive cultivation in Andalusia ‖ *Spanish Journal of Agricultural Research*, 6(2), 252-263.

Fadzilah Siraj & Nureize Arbaiy, 2006. Integrated Pest Management System Using Fuzzy Expert System, Proceedings of Knowledge Management International Conference & Exhibition (KMICE), Malaysia, Pages 169-176.

Harvinder S. Saini, Raj Kamal and A. N. Sharma, 2002. Web Based Fuzzy Expert System for Integrated Pest Management in Soyabean, *International Journal of Information Technology*, Vol 8, No. 2.

https://en.wikipedia.org/wiki/Expert_system

Khan, F. S., Razzaq, S., Irfan, K., Maqbool, F., Farid, A., Illahi, I., and Ulamin, T. 2008. "Dr. Wheat: A Web-based Expert System for Diagnosis of Diseases and Pests in Pakistani Wheat," Proceedings of the World Congress on Engineering Vol. I.

Nureize Arbaiy, Azizul Azhar Ramli, Zurinah Suradi, Mustafa Mat Deris, 2007. Pest Activity Prognosis in the Rice Field, Book-"Encyclopedia of Mobile Computing and Commerce", Volume-1, Pages- 763-768, Published by Information science Reference

Philomine Roseline, Clarence J. M Tauro, N. Ganesan ‖ Design and Development of Fuzzy Expert System for Integrated Disease Management in Finger Millets — International Journal of Computer Applications (0975 – 8887) Volume 56– No.1, October 2012

Prasad, R., Ranjan, K. R., and Sinha, A. K. 2006. "AMRAPALIKA: An expert system for the diagnosis of pests, diseases, disorders in Indian mango," Knowledge-Based Syst. 19(1): 9-21.

Robert F. Chevalier, Gerrit Hoogenboom, Ronald W. McClendon, Joel O. Paz, 2012. A Web-Based Fuzzy Eexpert System For Frost Warnings In Horticultural Crops. Environmental Modeling & Software, Volume 35, July Pages 84–91.

Sarma, S. K., Singh, K. R. and Singh, A. 2010. "An Expert System for diagnosis of diseases in Rice Plant," *International Journal of Artificial Intelligence*, 1 (1): 1-6.

Virparia P.V. 2007. A Web Based Fuzzy Expert System For Insect Pest Management In Groundnut Crop, 'Prajna' - *Journal of Pure & Applied Sciences*, 15, Pages36-41

Zadeh, L.A. 1965. Fuzzy sets, *Information and Control*., 8(3) Pages 338–353.

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