Chapter 3

Expert System Design for Diagnosis of Diseases for Paddy Crop

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ABSTRACT

India has the second largest area of arable (agricultural) land on this earth with heterogeneous agroclimatic regions across the country. India has the potential to grow a wide range of agricultural crops and varied raw material base for food processing industry. The paddy crop yield/hector of land is highest in Egypt is 9.5, while India is producing only 2.9. India’s lower paddy crop productivity/hector and higher cost of production is a major concern for farmers. There are various reasons for India’s low paddy crop yield, such as lack of mechanization, not adopting to modern method of farming, small land holdings, poor pests, and disease management. The recent survey discovered that there is huge gap in demand and supply in crop production and is likely to hit more than 15% by 2020, with the gap worsening to 20-25% by 2025. Researchers aimed to address this low crop yield issue by designing an expert system. This expert system helps the farmers by identifying and predicting the diseases for paddy crop to enhance crop yield and to reduce the supply and demand gap.

INTRODUCTION

India is an agriculturally based country and the agriculture is one of the most important economic sectors. About 75% Indian population is living in rural areas and depend on agriculture and allied activities. Food and Agriculture Organization (FAO) reported that 80% of the world paddy production comes from only seven countries. China contributes to 32.7% and India’s share is 26.0% to world paddy production. The
cost of producing paddy crop per quintal in India also varies from Rupees 639 in Andhra Pradesh, Rupees 783 in Madhya Pradesh and Rupees 435 in Bihar. These production and cost statistics highlights the urgent need to enhance the paddy crop yield/ha and to optimize the cost of production. There are several reasons for having low productivity in India, which is dominated by small farmers, having less than two acres of land, sometimes in hill stations. The present paddy crop cultivation machines are designed for large farmers in plane lands. Farmers are not using modern tools and methods of cultivation. The modern agriculture requires integration of information and knowledge from various sources. Nowadays the farmers usually depend on agricultural scientists and experts to get better information for their decision making. Agricultural scientists are not always available in remote areas when and where the farmers need them. To overcome these problems, the expert systems are developed as a powerful tool in agriculture to assist the farmers. The farmer can avail the services of these expert system using smart phones.

An expert system is an application software which imitates the thought process of human expert to achieve the performance equivalent to human expert in a particular problem domain. Expert systems is a subset of Artificial Intelligence domain. Authors have carried out an extensive survey of literature and identified several existing expert systems helping the farmers in taking very important decisions for diagnosis of diseases, disorders, pests, crop selection and crop management. The researchers have designed an expert system prototype for the diagnosis of various diseases affecting paddy crop by observing their disease symptoms. The step by step procedure adopted in designing rule based expert system is described in this chapter. This paddy crop disease expert system has three building blocks i.e Inference engine, Knowledge base, and User-interface. A user interface (UI) component is used enables communication between the system and the users. It allows the users to query the system or answering questions and to receive system advices. The collection of facts about the paddy crop diseases are designed in the form of rules and stored in rule base. The tacit knowledge is derived through interactions with domain human experts and later this knowledge is encoded in to a knowledge base. Users enter their inputs and questions through user interface. These questions are interpreted and processed by inference engine using the knowledge from knowledge base and rules. This expert systems provide advice to farmers based on user’s query and symptoms of the crop entered.

REVIEW OF LITERATURE

The precise identification of paddy crop diseases and pests is very essential for enhancing the rice crop yield and quality cultivation (Peng et al., 2010). The process of diagnosis of paddy crop diseases is very complex. Authors have applied Back Propagation Algorithm (BPA) of neural network technology to design an expert system for diagnosis of diseases, which is more efficient in processing incomplete and vague information. Authors (Li, Zhang & Yang, 2012) have proposed the characteristics of hybrid approach, such as self-learning ability of neutral network, inference ability of fuzzy systems and knowledgebase of expert system for prediction of crop growth. Authors have analysed growth rate of crop and the performance of expert systems using simulation and testing. The results obtained demonstrated that this practice is effective in the high crop yield management and better quality. Authors (Kaur, Singh Rekhi & Nayyar, 2013) have discovered that currently majority of Fortune 1000 companies are developing expert systems for enhancing the quality, efficiency and competitive leverage in their day to day operations. The expert systems are being used in scientific, business and industrial applications such as, to discover oil or mineral deposits, control various space crafts and diagnosing medical diseases.