IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 2, February 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 2, February 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1202028 |

Review: Expert Systems in Indian Agriculture

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ABSTRACT: In today's world, farmers are using multiple agriculture systems. These systems are used for crop prediction. Expert suggestions for crop management diagnosis of pests and recovery of crop problems as human experts are hard to find and they are inconsistent in their decisions. Human beings are unable to handle large data and their decisions are based on their experiences and sometimes they provide biased decisions. Availability of expert manpower is another major concern. On the other hand expert system provides more consistent, correct and non bias decisions and these systems are 24*7 available. Nowadays there are multiple systems available for crops like rice, mango, tomato, wheat etc. and these systems are helping farmers to identify different problems of crop and manage these problems. Some systems provide predictions and suggestions for crops based on crop pictures and soil reports. These suggestions are helping farmers to increase crop yield.

KEYWORDS: Data science, Artificial Intelligence, Expert System, Indian Agriculture, Information Technology Introduction (Heading 1)

I. INTRODUCTION

There are multiple factors in the farming field which degrade the production of crops. Traditionally farmers are taking help from senior farmers, agriculture officers and pesticide sellers. These people giving suggestions to farmers based on their previous experiences and similar kind of suggestions
farmers can get from an expert system.
Now what is an expert system? An answer for this is an Expert system is any sort of software, mobile application or web portal which helps farmers to solve complex farming problems.
These systems make use of artificial Intelligence, data science techniques to solve problems, provide suggestions, and make predictions. Expert systems have following models
1. Problem Solving Model
2. Diagnostic Model
3. Prediction Model
4. Management Model

Generally the Expert system has the following architecture modules.

1) Working Database or Memory
In this module the system performs calculations, computations and formations of images. This could be buffer memory and completion of tasks that erases the data.

2) User Interface (UI)
User Interface is used for interactions with systems through HTML forms, Audio Interfaces.
It provides input to the system.

3) External APIs
Some expert systems make use of external API endpoints. These endpoints are like weather, news and image processing API.

4) Knowledge Unit
In this module systems have huge datasets and on these datasets it applies data science algorithms and forms *the required patterns. These patterns further get used for analytical work.*

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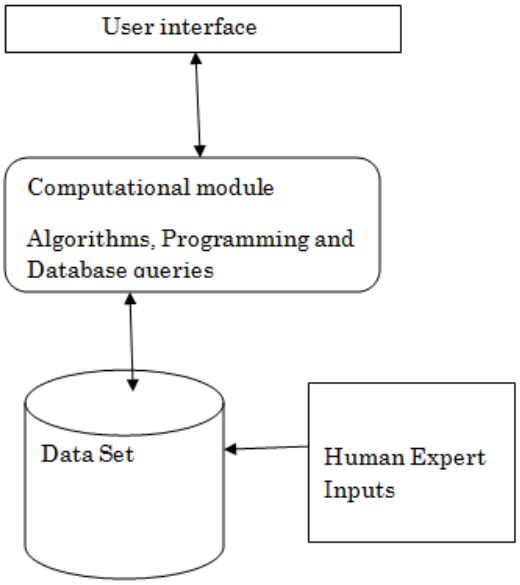

Conceptual Block Diagram of Expert Systems

II. PROBLEMS WITH INDIAN AGRICULTURE

Improper Farming Techniques
The Rural Indian farmers are using orthodox and inefficient farming methods and techniques of cultivation.

Insufficient Use of required Inputs
Indian agriculture and farmers are suffering due to insufficient inputs like fertilizers and crop seeds. Indian farmers are not using the required sufficient quantity of fertilizers on their soil due to lack of knowledge.

Incorrect proportion of pesticide
There is no awareness among Indian farmers about quantity and selection of pesticide for pest control which turns less productivity of crops.

Absence of Crop Rotation Technique
Proper rotation of crops is necessary for successful agriculture as it helps to maintain the soil fertility. As the Indian rural farmers are mostly illiterate, they are not very much aware about the benefits of crop rotation due to which the soil loses its fertility [2].

Agricultural Indebtedness
Farmers are losing their productivity every year arising from low prices of crops. The rural people are borrowing heavy amounts of loans regularly for meeting their requirements needed for production [2].

III. SOME EXAMPLES OF AGRICULTURAL EXPERTS SYSTEMS.

Rice-Crop Doctor
The National Institute of Agricultural Extension Management has constructed an expert system to diagnose diseases for rice crops and suggest preventive measures [1].

VARIEX
This expert system developed at Technical University of Brno, Czechoslovakia enables selection of the best cultivators for different agricultural situations [1].

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AGREX

Center for Informatics Research and Advancement, Kerala has developed an Expert System called AGREX to help the farmer by giving timely and correct advice to the farmers. This expert system is useful for fertilizer application, irrigation scheduling, and disease diagnosis on rice crops. [1].

Farm Advisory System

Punjab Agricultural University, Ludhiana, has developed the Farm Advisory System to support agriculture. The conversation between the system and the user is like the system asks all the questions from the user one by one which it needs to give suggestions on the topic of farm Management [1].

D. Benefits of Expert Systems

Detection and control crop disease

Farmers can easily detect their crops diseases using expert system for that they need not to visit pest control specialist and it could save their time and money

Irrigation Management

They can create irrigation schedules for their farm as per variety of crops, so they can manage irrigation for farms.

Identify proper pest control product

By detecting crop disease they can select proper pesticide for their crop which will increase productivity.

Fertilizer selection and their quantity

As per soil nutrient report and weather condition they can choose a particular fertilizer in the proper quantity for their crop.

IV. LIMITATIONS OF EXPERT SYSTEMS

1) Literacy rate of farmers in Indian society is poor and most farmers do not know how to make use of mobile applications and web portals and this is a major limitation for these systems.
2) Language barrier most systems designed in English language or in any local language and this is also a challenge for acceptance of the system.
4) Expert Systems are not providing creative responses like human beings.
5) This is a new domain and it's taking time for adoption in society .
6) Expert system should have more common sense, it should correct farmers while doing interactions.
7) Expert Systems should behave more like audio interfaces so that farmers can interact easily.

V. CONCLUSION

At present, agricultural experts are giving suggestions to Indian farmers. They are purchasing products, fertilizers based on suggestions given by them. Sometimes these suggestions work, sometimes not so farmers are facing huge loss because of this inconsistent and incorrect advice.

The expert system is helping farmers to increase crop production in a cost effective manner. These systems help farmers to make correct decisions but for this farmers need to get training, demonstrations and free exposures of these systems.

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Impact Factor: 8.379

doi cross ref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

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