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Expert System for Agriculture Using Sensors and Image Processing Techniques

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Abstract - Basically, India is agricultural land. Approximately 75% of Indians are farmers. But still some farmers are following traditional method for farming. The traditional methods leads to improper, inefficient farming practices as a result of which, farmers are not getting expected production and thus it affects on sale.
But using expert system we can reduce the chances of these problems.
So, we have studied existing expert system for agricuture. And on the basis of that, we are going to design an expert system for agriculture which consists
of:

1) Tesing of soil to determine soil quality and suggest fertilizer depending on soil quality.
2) Control plant disease and grow the plants in healthy environment.

Keywords – Sensors, image acquisition, segmentation, feature extraction, Soil nutrients, Blast, Brown spot

1. INTRODUCTION

In India, crop production has reduced in major amount. There are different factors which are affecting the overall crop yield and reduce overall profit. In India, farmers are still using the traditional methods for cultivating the crops, managing the crop production, plant diseases which decrease the crop production and overall profit. In order to resolve such problem and increse crop production we are going to design an expert system for agriculture. For that we have studied different existing systems. Considering this existing systems we are going to design an expert system for agriculture using sensors and image processing techniques .Expert system uses sensors for getting nutrient values of soil, send it to central processing system. System will process on that data will generate a result and displays information about soil quality. Another factor on which expert system will work is plant disease. To detect disease level expert system will use image processing techniques which include filtering, segmentation, feature extraction and classification. Depending on historical data expert system will predict level of disease and gives preventive measures for that. In plant disease we are mainly concentrating on rice crop and brown spot and blast disease. Thus, we are going to design expert system which will perform soil testing and plant disease prediction.

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2. LITERATURE SURVEY

In this section existing expert system for agriculture are discussed.
These expert system present different aspects related to agricultural.
Here overall area of research will be

- Selection of crop on the basis of soil test report and market demand.
- Live weather updates through internet
- Selection of pesticides and their amount according to the symptoms and climatic conditions. [1]

2.1. Plant disease prediction:

Identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product. This system helps in decion making of plant diseases.

This software system devoted to support decision making by the technicians of the agricultural advisory service when managing plant diseases. System adopts the Tropos methodology, agent-oriented software development methodology which includes intentional analysis techniques. The Tropos methodology is an agent-oriented software development methodology based on two key ideas, namely:

i. The use of knowledge level concepts, such as actor, goal, plan and dependency between actors, along the whole software development process.
ii. The critical role assigned to the preliminary phase of requirement analysis aimed at understanding the environment in which the system-to-be will operate.

Tropos covers four software development phases:

i. Early requirement analysis
ii. Late requirement analysis
iii. Architectural design
iv. Implementation. [2]

Other existing techniques for rice disease detection:

- Fractional zooming [3]
- Artificial neural network [4]

2.2. Soil Testing:

This website considers N, P, K value and pH value of soil for determining soil quality. It also suggests crops based on soil quality.

Crops can be chosen by using pH values.The pH value is nothing but percentage of hydrogen.It is the measure of acidity.Lower the pH value, higher is the acid in it. Acidic crops have pH value of 5or lower. Alkaline crops tend to have pH values higher than 5 upto 7. Fruits are acidic having low pH while vegetables are alkaline having high pH. Followinf table gives classification of soil depending on soil pH value: [5]

Table -1: Soil classification based on pH value

Denomination	pH range
Ultra acid	< 3.5
Extremely acid	3.5−4.4
Very strongly acid	4.5−5.0
Strongly acid	5.1−5.5
Moderately acid	5.6−6.0
Slightly acid	6.1−6.5
Neutral	6.6−7.3
Slightly alkaline	7.4−7.8
Moderately alkaline	7.9−8.4
Strongly alkaline	8.5−9.0
Very strongly alkaline	> 9.0

Smartphones have become a useful tool in agriculture because their mobility matches the nature of farming, the cost of the device is highly accessible, and their computing power allows a variety of practical applications to be created. Moreover, smartphones are nowadays equipped with various types of physical sensors which make them a promising tool to assist diverse farming tasks. This paper systematically reviews smartphone applications mentioned in research literature that utilize smartphone built-in sensors to provide agricultural solutions. [6, 7]

3. PROPOSED SYSTEM

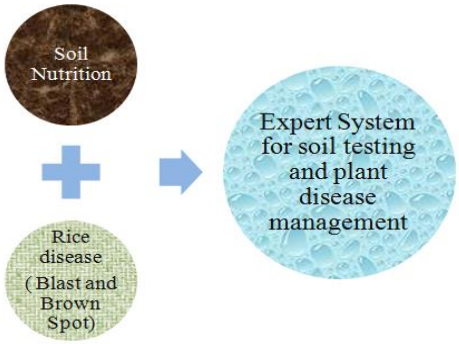

Fig 1. Proposed System Components

Based on existing system we are going to design an expert system for agriculture by considering two important factors of farming soil and plant diseases.
This system will takes the input as soil and image of plant using sensor and camera respectively.And gives the information about soil nutrients and diseases level if disease will be brown spot and blast, as an output. Followig figure gives process flow of proposed system:

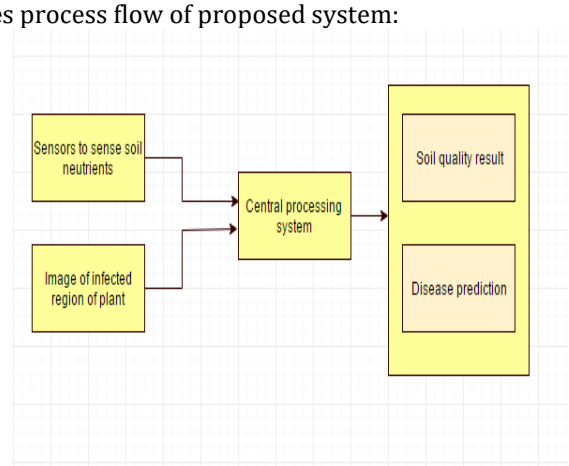

Fig 2. Processing flow of proposed system

3.1 Component Description:

1) First welcome form. When user will login the system there will be welcome screen consist of two options enter and exit.
2) If the user press Exit then the system will close automatically.
3) If the user presses Enter the system will proceed further and user can perform further operations.
4) User has to select the options to get information regarding to nutrients of soil and predicting diseases of plant.
5) System will take the input from sensors and camera then it will give to central processing.
6) Central processor will process the input and result will given to user as output.

3.2 Technical Specification:

For soil quality prediction, comparision is required with available data.

Existing system uses N, P, K and pH value of soil to determine soil quality. But in proposed system along with this major nutrient we are going to consider calcium, magnesium, sulfur and some trace elements (like iron, maganese, copper) of soil for better precision.[8]

We are having ideal value of nutrients for soil and depending on we will predict soil quality. Here we are going to consider climate also. Depending on soil quality and climate, system will suggest crop for that soil.

This will help to incease the crop production with minimal loss.

Second part of expert system is plant disease prediction.
For this we are considering two diseases brown spot and blast related to rice.

These two diseases having different levels (stages). By using image processing technique system will check the level and display level as well as curing and preventive easures for that disease.Following figure display the basic steps for plant disease detection and classification

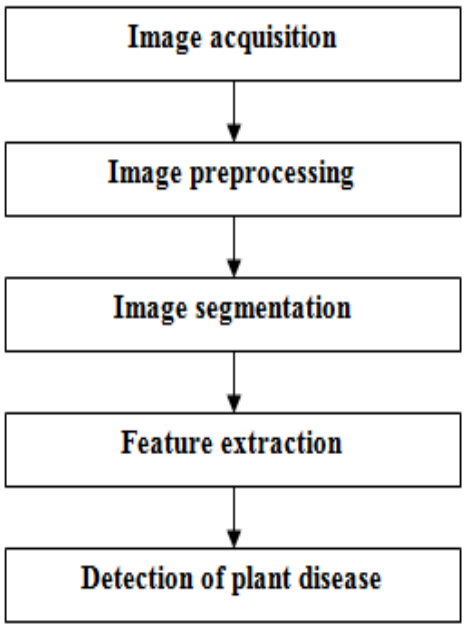

Fig.3. Basic steps of image processing technique. [9]

Third part of expert system is help option here system will provide some useful information about farming, news related to farming etc.

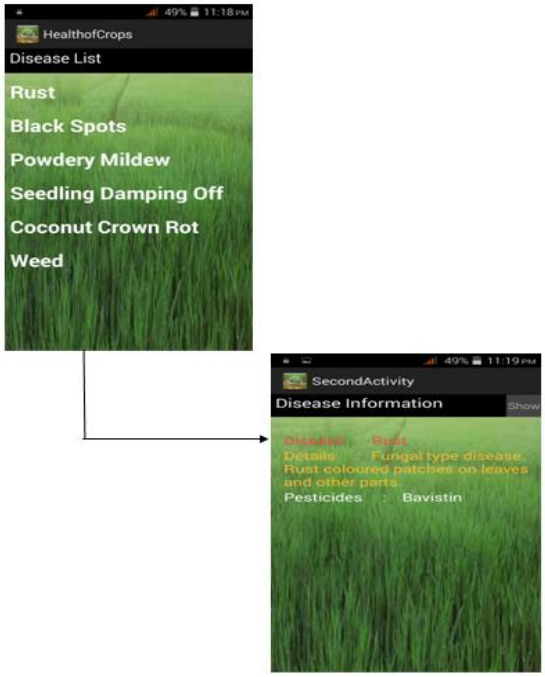

Fig. 4. Module of proposed system

Above figure represents one module of proposed system that is “help” button which will provide information like diseases list and information related to those diseases.

4. CONCLUSION

This paper discusses existing system for agriculture and proposed expert systen for agriculture. Proposed system concentrates on two factors soil quality and plant diseases.This system will help to increase overall crop production and minimize losses this will in turn increase overall profit.

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