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APPLICATIONS OF DIFFERENT TECHNIQUES IN AGRICULTURAL SYSTEM: A REVIEW

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Abstract-*Indian economy is highly dependent on agriculture. But people are not aware of proper maintenance of available land resources and the different plant disease. In this survey, the different algorithms or methods which are proposed to safeguard the agriculture system have been listed. In order to provide a perfect mixture of fertilizers and make the process of fertilization process less complicated a system is developed. They can provide high yield of crop rate. Next is the GSM based fertilizer and water irrigation system. This mainly concentrates on providing better treatment with the help of moisture and water level sensors by having two different modes i.e., auto mode and manual mode according to the convince of the user. Third is the automated fertigation process. This system mixes and supplies nitrogen, phosphorous and potassium along with the water to the soil. The ratio of the components can be fed by the user directly. This method uses wireless sensor networks for providing better communication through the system. Hence, to make a large scale production the better irrigation and fertilization is needed. In addition to this for identifying and classifying five cotton plant diseases an algorithm is proposed. This provides the name of the plant disease to the user after identification using the android app. Another automatic plant disease algorithm is developed using gaussian smoothing approach and image processing. Traditional methods can be followed with little addition of recent trends which can make the agriculture more precise.*

Keywords- **Plant disease, Image Processing, Irrigation, Fertilization, SVM**

I. INTRODUCTION

Agriculture is a most important sector of Indian economy. Indian agriculture sector accounts for 18% of GDP and provides employment to 50% of the countries workforce. Agriculture has become much more than simply a means to feed ever growing population. More than 70% population depends on agriculture in India.

Primary agriculture crops are threatened by a wide variety of plant disease and pest. About 42% of the world's total agriculture crop is destroyed yearly by disease and pests. Plant disease causes substantial losses in yield of plants which leads to huge economic losses. Accurate identification and diagnosis of plant diseases are very important in the era of climate change and globalization for food security as well as prevention of the spread of pathogens. This can be solved via recent technologies which can provides sensing, processing, communication, monitoring and controlling events with the device itself. Here image processing place important role. This paper provides a wide survey carried to study advances in different image processing techniques used for studying plant disease and to recommend the fertilizer.

II. LITERATURE SURVEY

Dr. V. R. Pawarin paper "Machine Learning Regression Technique for Cotton Leaf Disease Detection and Controlling using IoT" proposed a Support Vector Machine based regression system for identification and classification of five cotton leaf diseases i.e. Bacterial Blight, Alternation, Gray Mildew, Cereospra, and Fusarium wilt. After disease detection, the name of the disease along with its remedies is provided to the farmers using android app [1].

Isaac Kofi Nti, Yeboah Samuel Jonas and Gyamfi Eric in paper "Detection of Plant Leaf Disease Employing Image Processing and Gaussian Smoothing Approach" proposed computer vision techniques to uncover the affected spots from the image through an image processing technique capable of recognizing the plant lesion. This automatic plant disease detection theory has achieved accuracy of 90.96% from the experimental results [2].

Cyril Joseph, Thirunavuakkarasu, Aadesh Bhaskar and Anish Penujuru in paper "Automated fertigation system for efficient utilization of fertilizer and water" proposed a system to mix the fertilizers in the required ratio for the crops and feed it through the irrigation lines. It also maintains the soil moisture content at optimum levels, thereby helping the farmers to increase their yield with appropriate rate [3].

M. O. Sharma and P. M. Sonwane in paper "Remote Monitoring and Control for Liquid Fertilizer and Water Irrigation" proposed an android based agricultural support system for both fertilization and irrigation. Monitoring and controlling of process is carried out with the help of information from level detector and soil moisture sensor [4].

III. SYSTEM ALGORITHM

A. Methodology for Cotton Disease

The Fig 1 shows the main steps of disease detection and they are:

- Image Acquisition
- Pre-processing
- Segmentation
- Feature Extraction
- Classification

The image databases are gathered[1]. In preprocessing unit, the images are enhanced by resizing it into 250x250 pixels and removing the noise by median filter. Segmentation unit segregates the lesion region from the leaf.

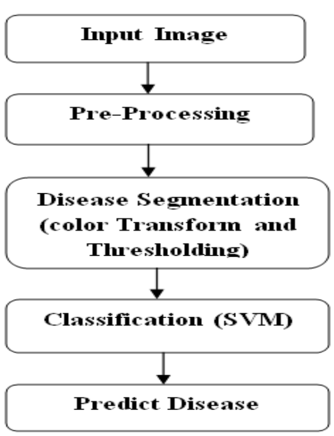

Fig.1 Design for Cotton Leaf Disease Detection

Then the image is converted from RGB to YCbCr color format. After conversion bi-level threshold is applied this defines two threshold ranges for three color plane. Bit wise operation is performed on RGB image from the black and white logical image.

RGB is again converted to grey image to show the diseased part in color mapping unit. Totally eight color and textures features are extracted. Color features are extracted using color correlation, color histogram, color moment, color descriptor and texture features from 2D Gabor filter. SVM based regression technique with non linear Gaussian kernel is used for classification of disease. The experimental results are shown in tabular column [1].

B. Methodology for Disease Detection

The below design flow is the disease detection algorithm for the leaf. The proposed methods are further divided into subdivision:

- Acquisition of RGB Image
- Convert of RGB image to HSV image format
- Green Pixels Masking
- Masked green pixels removal
- Segmentation of components
- Extract the valuable segment
- Evaluation of texture statistics

The images of the plant are captured and color transformation structure is created for the RGB leaf image. Then device independent color space transformation is applied. In preprocessing unit, image clipping is made for cropping the leaf to get the interested plant region, image smoothing for using smoothing filter and image enhancement to increase the contrast.

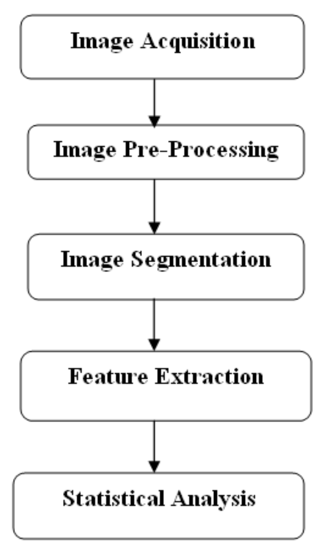

Fig 2 Basic process for Disease Detection

RGB is converted into grey image using color conversion formula as shown below.

$$f(x) = 0.299 \times R + 0.587 \times G + 0.114 \times B$$

The Gaussian smoothing operator is a 2D convolution operator which is used to smooth the images and remove noise. The segmentation is done using various methods such as k-means clustering for detecting the boundary. Colour, texture, morphology and edges are the features used to detect the plant disease. The experimental results are shown in the images [2].

C. Methodology for Automatic Fertigation Process

There are five pumps in the system 1, 2, 3 for N, P and K respectively to the mixing tank, pump 4 to pump out the fertilizer and pump 5 to pump out the water. All the pumps are controlled by the microcontroller. The Wi-Fi module helps in transmitting the parameters entered by the user to the microcontroller. The system works in two modes. In first mode, if there is output from the sensor the water is pumped for high level and if there is no output then the alternative watering method is followed. In second mode, two parameters such as time interval between successive watering and ON time of the pump are given.

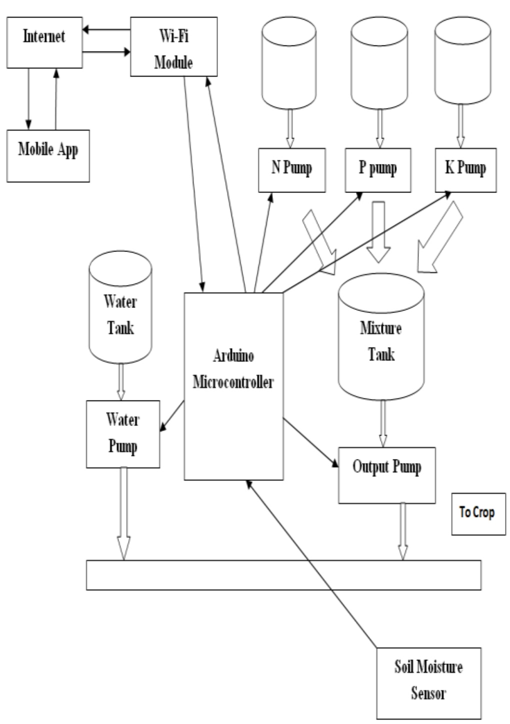

Fig. 3 Overall model of the Automatic System

The Fig 3 shows the overall model of the automatic fertigation system for efficient usage of water. The configuration is studied from the information [3].

D. Methodology for Remote Monitoring Liquid Fertilizers and Water

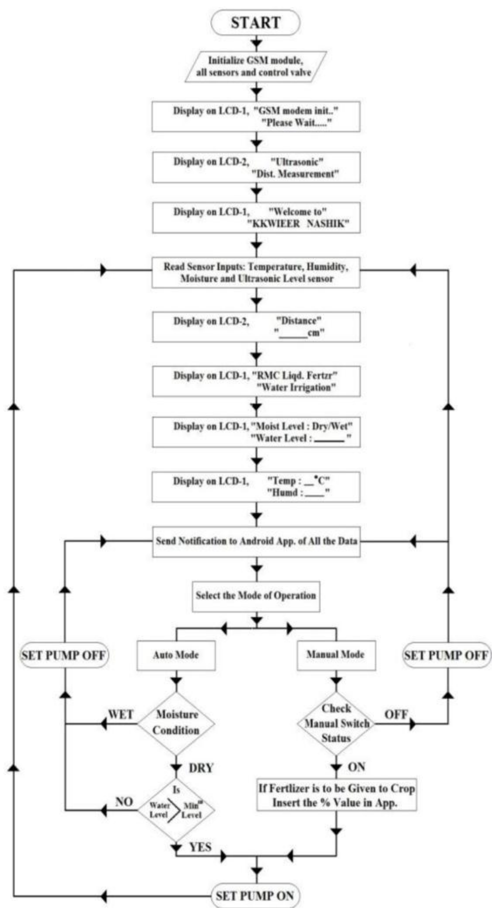

Fig. 4 Algorithm for Monitoring Irrigation and Fertilization

The Fig 4 shows the flow design of the system for monitoring and controlling the injection of fertilizer and water. The moisture sensor, level sensor, humidity sensor and temperature sensor gather the inputs and feed to pic microcontroller. Depending upon the mode of operation, further actions are made. In the auto mode, the pump is switched to ON or OFF state according to the status of the moisture sensor. In the manual mode, the system checks for the input of fertilizer to be injected. If there is input the injection of fertilizer is continued. Otherwise, the system does the work of water irrigation. The further details are showed in the description [4].

E. Methodology for Intelligent Drip Irrigation and Fertigation

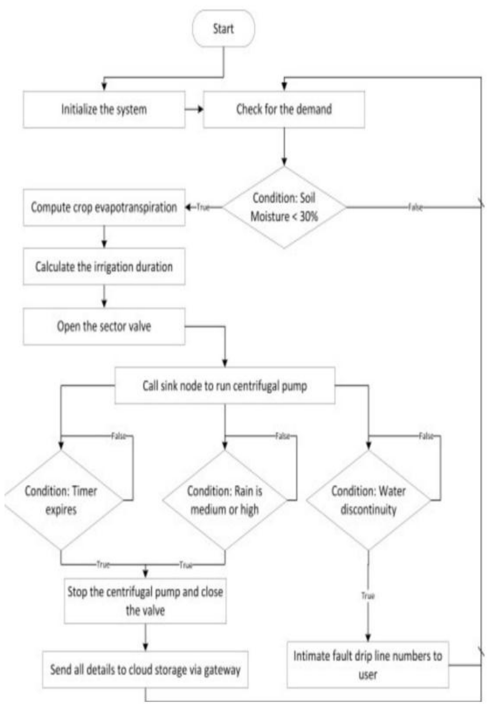

Fig.5 Flow diagram for PM FAO-56 Model

$$Continousflowrate = \left(\frac{WaterNeed}{8.64}\right) * (thehectare).$$

$$Rotationalflowrate = (24/H) * (7/D) * (continousflowrate).$$

Crop evapotranspiration estimates the amount of water needed to irrigate the crop for its optimal growth. The reference evapotranspiration is multiplied with its corresponding crop coefficient to estimate the water. Its unit is mm/day. The shown model in Fig 5 incorporates aerodynamics and surface resistance terms. Crop factor is determined based on the stages of the growth. Et (crop) = ET_{ref} * Kc. Calculate SAR (H_2O to saturate the root zone). Amount of percolation and seepage losses is determined based on the type of soil. Calculate the water needed using

Water `Need = Etcrop + SAR + PESE + WLayer – effR

Calculate continuous flow and rational flow using

The injection of precise amount of fertilizer to the crop helps in reducing the soil erosion. Hence, the overall system accuracy counts for higher percentage.

IV. RESULT

The experimental results of different methods are compared with each other to give the appropriate solution to enhance the agricultural system. The detection of plant disease using Gaussian smoothing approach provides about 90.96 % when compared to 83.26 % obtained by machine learning regression technique. The evapotranspiration process is way better than other fertigation and irrigation process because of its precise calculation. If the agricultural system is wanted to be more reliable to give higher yield rate the following suggested methods can be used.

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