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Detection of Nutritional Disorders in Pepper and Pomegranate Plants using MATLAB and LabVIEW

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Abstract- **This paper provides identification of the diseases at early stages in pepper and pomegranate plants using image processing techniques. Image processing and standard data base is extensively used in the proposed work. Various nutritional disorders of pepper and pomegranate plant lead to change in color of the leaf. These visual symptoms are derived from images of the defected leaves of pepper and pomegranate plants. By detecting nutrient deficiency with this method, plant life span and yield can be improved by providing proper and suitable quantity of manure. MATLAB and Laboratory Virtual Instrument Engineering Workbench (LabVIEW) are the used tools in this process. LabVIEW provides Visual programming methods for image acquisition, image processing. MATLAB and LabVIEW provide easy and convenient methodologies for image processing techniques.**

Keywords: **Nutritional deficiency, LabVIEW, Image processing, RGB color.**

I. INTRODUCTION

As agriculture is India's backbone, it has played a key role in the development of human civilization. An attempt in this process is made to solve farmers' day to-day problems. The usual difficulty faced by farmers in controlling diseases is observation of diseases by naked eyes which leads to expensive threat to plants life span. Most dominantly this method is used in agricultural field, botanical research centers, agricultural authorities and plant nurseries.

Helps in detecting disorders in very early stages of growth leaf. Because of their medicinal, stimulus, edibility importance, pepper and pomegranate plants are selected in this process. Since this process helps in detecting nutritional disorders in earlier stages of the plant, it helps farmers to improvise their yield and produce efficient crops.

Vision and Development toolbox of LabVIEW, presents a complete set of digital image acquisition [1]and processing functions that work with higher resolution of the image with different algorithm. Our way of dealing with this problem is to have an algorithm designed regarding all the data we collected about pepper and pomegranate plants.

By detecting the defected region in leaf, masking is performed on that image to cover the leaf region with the standard green color that pepper and pomegranate leaves possess. Original image which contains defected leaf picture is subtracted from the image which is masked so that the difference is obtained. This difference is analyzed using data[6] and algorithms available.

If the input leaf is suffering with more than one deficiency then a healthy leaf model stored in database should be retrieved.

The evitable and expected fact is that same technique can be used in future with the knowledge of any other crop and its behaviors for related deficiencies.

Through the technique of image processing, it is possible to study about various deficiencies in plants by examining visual symptoms. These symptoms are derived from images of defected leaves. This is possible in MATLAB and LabVIEW.

OBJECTIVES

1) To provide a technology effective solution for concerned authority and farmers to identify the diseases at early stages in pepper and pomegranate plant by making use of image processing technique. This serves the immediate requirement of engineering and technology for the socio-economic benefit, in particular and economic development of country in large.
2) It is one of the non-invasive automatic method of detecting the deficiencies in leaf.
3) By detecting nutrient deficiency with this method, plant life span and yield can be improved by providing proper and suitable quantity of manure.
4) This method needs one time investment and looking into its long term and reliable use it is cost effective.
5) Color based image retrieval is an important research area in digital image processing through LabVIEW.

6) An opportunity for the team to learn image processing, requirements of algorithm like edge detection, color matching, color moment and feature extraction techniques.

II. PROPOSED METHOD:

A. System

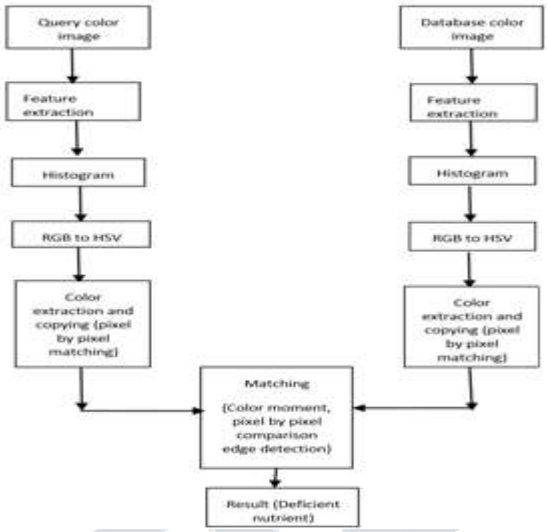
In this process, farmers can take a picture of infected plant leaves. The system so developed will be uploaded with this picture. The picture is analyzed to find the kind of disease the plant is infected and a proactive approach to stop the disease based on the system results will be informed to the farmers.

A process in which farmers are just required to capture the defected leaf and the same image is submitted to the system where the defected leaf is compared with real leaf model and hence giving out the results of their difference and indicates the kind of deficiency that leaf/ plant is suffering [4].

B. Working mechanism

Process will initiate with the defected leaf image which is given as input, further feature extraction (color properties, RGB values, shape of the leaf, color pattern of the defected region)[3] of image is done. This image is stored in the database created for the storage of the image obtained which is to be used for color matching and color moment parts of algorithm in fore coming steps. The image processing techniquestarts with the image histogram [3] (graphical representation of the tonal distribution in a digital image) and RGB (Red, Green, Blue) to HSV (Hue, Saturation, Value of intensity) conversion and if required to gray scale and binary images. When storing pixel values of an image [2] [5], conversions of data types like integer to double floating and vice-versa are also done.

The recognized image of the leaf is matched with the original image stored in the database. The method of image subtraction is used for matching process. The difference in the images is put into an algorithm to obtain the deficient nutrients as the final result. Some examples of programs are shown below with their outputs.



Block Diagram: *Fig. 1. Block Diagram*

Here are steps to be followed for proposed method:

I. Image Acquisition
II. Resize the image.
III. Convert image into gray scale image.
IV. Obtaining the edges of an image.

V. Histogram and Conversions.
VI. Image Subtraction.
VII. Extract the features

Match the pattern for recognition

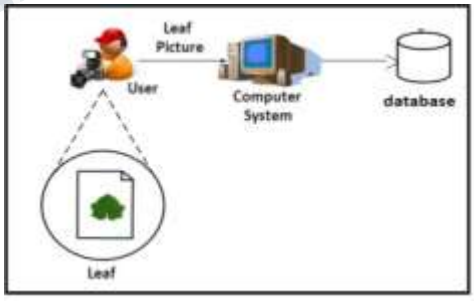


Fig. 2. Pictorial overview of proposed method.

MATLAB program for edge detection:

```
figure(1)
a = imread('pepper.jpg')
b = rgb2gray(a)
sob_im = edge(b,'sobel')
imshow('pepper.jpg')
figure(2)
imagesc(sob_im)
```

```
axis('square')
colormap('gray')
imshow(sob_im)
```

(output in fig.4)

MATLAB program for RGB to Gray conversion:

```
A = Imread('image_name.image_type');
B= rgb2gray(A);
Imshow(B)
```

(Output for the above program is in Fig. 5)

Fig.3. Input image

Fig.4. Edge detected image

RGB to GRAY conversion:

Fig.5. Grayscale image Masking

Fig.6. Masked Imag

```
img = imread('pepper.jpg');
for R1=1:513
for C1=1:655
pix = img(R1,C1);
end
end
figure(1), imshow(img)
my_image =imread('ser.jpg');
for R=25:630
for C=25:332
pixel=my_image(R,C);
if pixel<50
pix=255;
elseif pix == pix;
end
end
end
for R1= 25: 630
for C1= 25:332
img(R1,C1) = pix;
end
end
figure, imshow(img)
```

Masking is done on image to cover the leaf region with the green color which healthy leaves possess.

We use color pattern matching to locate known reference or fiducial patterns in an image quickly. Pattern matching is the key to many applications. Color pattern matching can provide our application with information about the presence or absence, number, and location of the pattern within an image.

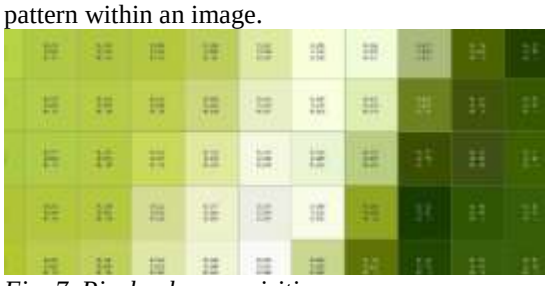


Fig. 7. Pixel value acquisition.

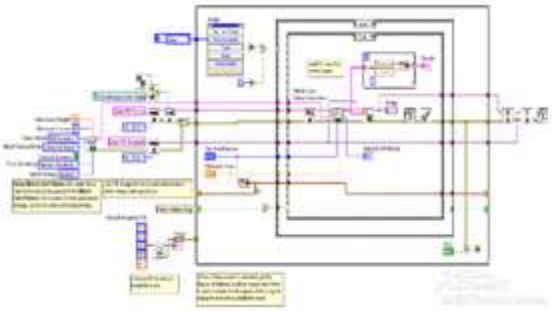


Fig.8. Color pattern matching

Program: While bringing algorithm out in terms of executable programs in LabVIEW , most of the Vis are written using mathscript module. And the further approach will be converting every mathscript code into VI using LabVIEW.

Deficiencies in pepper plant:

Fig.9. Signs of deficiency

Fig 10: Deficiency in pomegeranate leaf

Comparison of pomegranate leaf:

1.Fresh leaf **2.Nitrogen deficient**

Deficiencies in pomegranate:

3. Nitrogen deficient **4. Calcium deficient**

5. Potassium deficient **6. Iron deficient**

7. Sulphur deficient **8 .Zinc deficient**

Table 1:Visual symptoms exhibited by pepper plant under nutritional disorders[6]

Nutrient	Deficiency symptoms	Excess/Toxicity symptoms
Nitrogen	Plant development gradually slows down. Gradual drying. Beginning at leaf margins of the areas between the lower leaf veins. The petioles bend and hang downwards, parallel to the stem. The plant develops few flowers and fruit setting is poor. The fruit receptacle is thin, and the ovary is small. Sometimes there is no fruit development on the plant at all, and on those plants that bear fruits, the fruit is deformed.	Plants are usually dark green in color, have abundant foliage but with a restricted root system. Flowering and seed production can be retarded.
Potassium	Yellow chlorotic spots appear between the leaf veins, firstly in the lower leaves. The veins and the areas adjacent to these spots do not change their color. (This can be seen mainly in the upper parts of the plant). There is little fruit setting, and most each fruit, which is smaller than usual.	Usually not excessively absorbed by plants. Excessive potassium may lead to magnesium, manganese, zinc or iron deficiencies.
Sulphur	Causes leaves to become yellowish.	Reduction in growth and leaf size. Leaf symptoms often absent or poorly defined. Sometimes interveinal yellowing or leaf burning.
Magnesium	Is common in pepper plants. Yellowing of the leaves is apparent in the interveinal areas and veins remain green. The oldest leaves are affected first. Sometimes magnesium deficiency occurs when excess of potassium have been made. It may also show up under extremely hot dry weather.	Very little information is available.
Iron	Symptoms show at the later stages of growth. The young leaves fade and then become yellow in the areas between the veins. The veins remain green.	Rarely evident in natural conditions. Has been observed after foliar iron sprays manifested as necrotic spots.
Manganese	Chlorotic spots between the upper leaf veins.	Sometimes chlorosis, uneven chlorophyll distribution. Reduction in growth. Lesions and leaf shedding may develop later.
Zinc	The leaves become narrow and small in width.	Excessive zinc commonly produces iron chlorosis in plants.
Copper	Appears late in the reproductive stage. The leaf margins curl and dry up. The leaves and the fruit become narrow and rectangular.	Reduced growth followed by symptoms of iron chlorosis, stunting, reduced branching, thickening and abnormal darkening of rootlets.

III. APPLICATIONS

As agriculture is India's backbone, and our project is also dealing with farmers' day-today problems and finding solution in cost efficient and an easiest way.

1. Most dominantly this method is used in agricultural field, botanical research centers, agricultural authorities and plant nurseries.
2. Helps in detecting disorders in very early stages of leaf growth.
3. This method is best used where the farmers are hard to reach authorities concerning medical care of their crops.

IV. CONCLUSION:

This system, will be a boon to the farmers as it provides accurate and quick solution to plant diseases at nominal or no cost to the individuals. After the complete implementation, we will have a great satisfaction of bringing technology to the use of farmers at the nearest possible way.

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