

Determination of Soil pH by using Digital Image Processing Technique-A Review

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Abstract — Image processing has been proved to be an effective tool for analysis in various fields and applications. In Agriculture sector the parameters like quantity and quality of product are the important measures from the farmers’ point of view. Soil is recognized as one of the most valuable natural resource whose soil pH property used to describe the degree of acidity or basicity which affect nutrient availability and ultimately plant growth . pH of 7.0 is neutral, and soils above or below this value are either alkaline or acidic, respectively. This paper discusses the various methods and techniques involved in the field of image processing to detect Soil pH.

Keywords- Cloud computing; Security; Public cloud, Private cloud, Hybrid Cloud, policies, cloud transparency

I. INTRODUCTION

The pH of soil is an important factor in determining which plants will grow because it controls which nutrients are available for the plants to use. Knowing the pH of the soil will quickly allow user to determine if the soil is suitable for plant growth and what nutrients will be most limiting .It provide information on the potency of toxic substances present in the soil. It is indicative of the status of microbial communities and its net effect on the neutralization of organic residue and the immobilization of available nutrient. Soil pH is a measure of the relative acidity or basicity of a given soil. The pH scale (0-14) is a logarithmic expression of hydrogen ion activity. A pH of 7.0 is neutral, and soils above or below this value are either alkaline or acidic, respectively. A soil with a pH of 6.0 is ten times more acidic than a soil of pH 7.0. Changes in soil pH dramatically affect the availability of nutrients to growing crops. The pH meter is the preferred method for determination of soil pH.

A soil analysis is a process by which elements such as P,K,Ca,MG,Na,S,Mn,Cu,Zn are chemically extracted from the soil and measured for there “plant available “ content within the soil sample. The soil pH reflect whether a soil is acidic ,basic or alkaline . The acidity ,neutrality or alkalinity of a soil is measured in terms of hydrogen ion activity of the soil water system .The negative logarithm of the H ion activity is called pH and thus pH of a soil is a measure of only the intensity of activity and not the amount of acid present . The pH range normally found in soil varies from 3 to 9 .

Mathematically pH is represented as ,

$$\log 1/H = \log H^+$$

Following table shows soil pH and Interpretation

<5.0	5.5	6.0	6.5-7.5	7.5-8.5	>8.5
Strongly acid	Moderately acid	Slightly acid	Neutral	Moderately Alkaline	Strongly Alkaline
			Best Range for most crop		

pH Requirement of some of the commonly Grown vegetable

4.5 - 6.0	5.5 - 7.5	6.0 - 7.0	6.0 - 7.5
potato	Peas Cucumber	Onion	Cabbage

soil pH can be determine from soil color using on digital image processing techniques. in which digital photographs of the soil samples were used for the analysis of soil pH.

Soil color is visual perceptual property corresponding in humans to the categories i.e red, green, blue and others. Soil colors are the parts of visual perceptual property where digital values of red, green and blue (RGB) provide a clue for spectral signature capture of different pH in soil.

II. LITERATURE SURVEY

In year 2011, the author M.A.A. Mashud et. [1] explained a digital pH meter using microcontroller to measure the pH of blood. This design system is simple and clinically applicable. The developed system is tested among 15 patients and found sound result. In this work to avoiding the external oscillator circuit and MC14511B is used as a buffer and driver circuit.

M.A. A. Mashud, M. H. Uddin and Md. Serajul Islam [2] developed a digital pH meter to measure the pH of soil using a fast response microcontroller PIC16F876. In this work for better performance external oscillator circuit is used. For quickly real time display MC14511B is avoided and common cathode display is used.

Vinay Kumar¹, Binod Kumar [3] developed technique using digital image processing Soil samples were collected from Nathnagar block of Bhagalpur district and after processing soil pH were determined by using pH meter. Determination of soil pH was based on digital image

processing technique, in which digital photographs of the soil samples were used for the analysis of soil pH. Soil pH were analyzed from RGB value and plotted for result. Equation values (Soil pH index) of deep brown colors are different from light yellowish and greenish Soil pH values in deep brown color were different from yellowish and other grey colors. Ranges of soil pH and pH index values were 7.30-7.50 and 0.0070-0.0261, respectively in deep brown color. Similarly, soil pH range varies from 6.80-7.04 and 5.58-6.58 in light yellowish and greenish color respectively while their corresponding pH index values were 0.0071- 0.0451 and 0.0084-0.0239.

Makera M Aziz* .Dena Rafea Ahmed ,Banar Fareed Ibrahim[4] find the pH value of soil, according to the soil color by using neural network. The sample of soil is taken from many lands and its pH value was estimated according to the sample color. That mean database is needed for this purpose to compare the current soil sample with, and find its pH value. The colour values (RGB) of the soil will compare with the color values of the samples that already store in database and find the minimum error to determine the pH. value of the current sample. That means the value that need to store in the database is the basic color value (RGB) and the pH value of each sample that already collected. And the data needed for the sample that we want to find its pH. are (RGB). The two RGB values of the sample and database will compare to find the value of pH using neural network. Analysis of comparisons between real values of pH calculated using the chemical analysis and pH

[5] estimated the water content of soil by using two colour spaces of digital image (RGB) and (HSV). He discovered that the soil became darker when the water content increase and the soil wetted up, but this will be in a limited range. The regression analysis has been used to find the relation between the color of the soil and the water content of the soil. He found there is a strong relation between soil color and water content of soil, light color of the soil refers to that the soil has poor organic matter.

[6] Determined the solute concentration of soil by developing model based on digital image. Chemical analysis and soil sampling were used to find the relation between the dye content of soil and the value of digital image color (red , blue and green). The pre-processing is used to detect some of the error that in digital image. Before image analysis to determine the soil color at sampling point in profiles. The polynomial regression is used to build the model with a primary color (RGB) validation of the technique with independent data showed the methods estimated the concentration of the dye well.

[7] use fuzzy logic method with matlab software for determining soil PH. A fuzzy system is successfully design in order to control soil ph .The input for this system is temperature ,light intensity ,humidity By constructing fuzzy system the condition for the roses to grow is collected and analyzed.

III PROPOSED METHODOLOGY

Basic steps for PH Detection of soil using image processing as shown in fig. 1

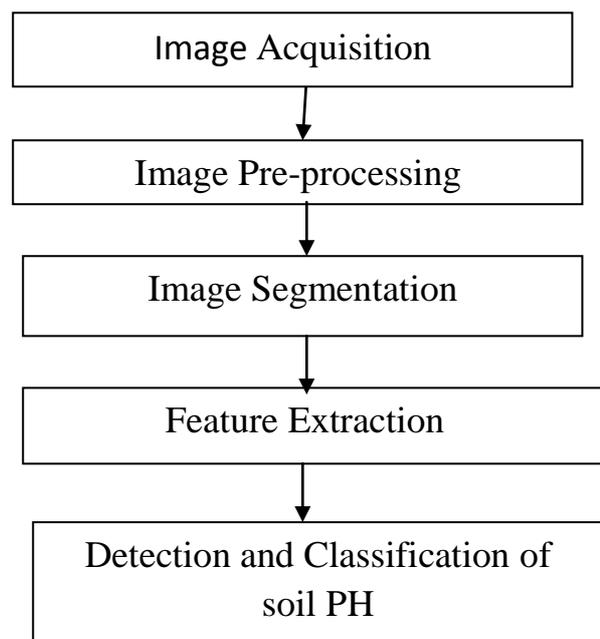


Fig.1

The processing scheme consist of image acquisition through digital camera or scanner or mobile phone. Image processing includes image enhancement ,filtering of image to remove noise etc .image segmentation ,feature extraction and Detection.

1) Image Acquisition :-

Firstly the images of various area of soil captured using digital camera with required resolution for better quality or by scanner .The construction of database is clearly

dependent on application. The images database is responsible for better efficiency which decides the robustness of algorithm .

2) Image Preprocessing:-

Second step is to improve the database of images that suppress undesired distortion. Enhance image feature is important for further processing and analysis task .It includes color space conversion ,image enhancement for contrast improvement ,image resizing ,filtering to remove noise etc.

3) Image Segmentation :-

Segmentation means partitioning of images into various part or region and extracting meaningful region known as region of interest (ROI).The level to which subdivision is carried depends on the problem being solved .Segmentation can be stopped when the region of interest in an application have been isolated. Segmentation accuracy determines success or failure of computerized analysis procedures. So algorithm picked for segmentation should perform best for given requirement.

Image segmentation algorithms generally based on two basic principle :discontinuity and similarity. The discontinuity principle is to extract region that differs in properties such as intensity ,color texture or any other image statistics. In similarity principle, an image pixel are grouped into region that are similar according to a set of predefined criteria. Thresholding ,region growing, region splitting and merging are example similarity principle .As different segmentation techniques are present such as k-mean clustering, fuzzy c-mean clustering ,penalized fuzzy c-mean clustering ,ostu threshold algorithm etc.

4) Feature Extraction:-

Feature extraction plays important role for identification of an object .After segmentation the area of interest Image feature includes color, , texture..Texture means how the color is distributed in the image ,roughness, hardness of the image .There are various methods for feature extraction such as color co-occurrence method, leaf color extraction using H and B components ,gray level co-occurrence matrix ,Gabor filter ,wavelet transform etc.

5) Classification:-

A classification technique deals with classifying each pattern in one of the distinct classes. There are so many classification techniques such as k-nearest neighbor classifier ,probabilistic neural network ,genetic algorithm ,support vector machine(SVM),principle component analysis (PCA), artificial neural network, fuzzy logic etc. Selecting a classification method is always a difficult task because quality of result can

vary for different input data. So for our application we can select the classifier used to classify Ph value of soil.

IV CONCLUSION

In above survey we focus on different methods for detection and classification of soil Ph. Also in proposed methodology we discuss different methods of segmentation, feature extraction ,and classifier We can modified available algorithm so that we will obtain good accuracy and efficiency in determination of soil pH. Advantages of accurate and early detection of soil Ph is that we can determine which crop is suitable for particular soil which helps to increase agriculture productivity.

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