Testing of Agriculture Soil by Digital Image Processing

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Abstract— Soil Testing is the way to access the soil constituent which is useful to know fertility and acidity of the soil. This paper helps to determine the amount of fertilizer and pH of soil that must be applied. From Farmers perspective soil pH value plays an important role because growth of plants and vegetables based on pH factor present in the Soil. Generally soil pH is measured manually in Government Labs. There are various labs but instrument used for this is not available everywhere. So we need to implement calculation of soil pH by using digital Image Processing. Eighty soil samples were collected and their pH firstly tested in Government Soil Testing Lab, Agriculture College Nagpur and also it was determined by using digital image processing technique. On the basis of RGB values, pixels properties and their digital correlations, results showed that our pH values were approximately matching with results from Government Testing lab.

Key words: Soil pH, RGB values, pixels, Government Lab

I. INTRODUCTION

India is known as one of the famous agricultural country. Farmers have high range of variety of crops. So farmers can decide the crop which grows more in their soil. This can be done when we know the constituents as well as pH value of the Soil. Most of the farmers do not perform soil testing because existing methods consume time and money. Very few farmers rely on soil testing done by government labs which are not available near them.

Soil testing is the way to know quantity of fertilizer to meet the necessity of the crop by taking advantage of the nutrients already present in the Soil. It will also help to know the soil problems to overcome. The Soil pH value plays an important role in soil analysis. Soil pH tells us the acidity as well as basicity present in the soil because if soil is very acidic then it affect to the growth of the plants.

The elements like Nitrogen (N), phosphorus (p), potassium (k) and iron could not be taken by the plants if the soil is very sour as well as too sweet.

A pH value ranges from 1 to 14, pH value below 7 is acidic whereas above 7 is alkaline. Soil pH is called as main variable in soil as it will control many chemical and biological processes that take place in the soil. The most suitable range for many plants is between 5.5 to 7.0.

The important of Soil testing plays an important role in the farmer’s life. Just because of lack of available resources as well as time and money consuming, many of farmers doesn’t take advantage of soil testing.

II. LITERATURE REVIEW

Some research regarding the soil testing has been publishing in the past decades. But no such software is present which allows real time testing and analysis of the pH, type and properties of soil. But no one has exact output till now. Soil Testing is one of the most required issues in the farming. Farmers do not have software to analyze their soil and apply required fertilizers. The existing methods of soil testing are time consuming and are done manually by collecting soil samples. The existing soil testing is done in Government labs by manually collecting the sample and then analyzing it and generating results. This process is very time consuming and not readily available near all the farmers.

India there was few laborites available for farmer so they were not getting the use of soil testing. Due to this problem farmers cannot identify which crop suitable for the soil and resulted to loss or damage of crop.

As per growth in technology we want to focus the working of soil testing is done by using some modern technology. We are taking some references from previous papers we found that papers are based on theory but actual system is not build till now. Some of research paper based on segmentation of soil as taking picture of soil by Satellites (Taken from Reference 1), so the results not seems proper calculation of agriculture constituents.

III. PROPOSED SYSTEM

The Proposed System is a desktop-based application, which can be used for finding pH value of soil sample. The main objective of the project is to provide availability of soil testing. We are trying to implement it with Database Application. It is very useful for the farmers as well as for government laborites.

The Objectives are as follows –
1) To identify the type of soil
2) To determine the pH level of soil
3) To determine the properties of soil
4) To make the soil testing simple and easy for farmers.

As per the requirement of the system as automated we want to make software which process and give some intermediate results. So the people who want to test the soil can easily test it by using software.

Digital Image Processing is a term in which digital images will be taken and calculate some values from it to perform particular operation on it. As many algorithms are used to perform mathematical as well as scientific operation on digital images. By using the digital image processing we can implement our system based on need. The System work as by providing the image file of soil sample as input and then RGB value of each image of soil sample will be calculated by using digital image processing and by using some constrained we give soil pH and the constituents of soil as output.

IV. MATERIALS AND METHODS

Soil samples were collected from Government Soil Testing Lab, Agriculture College Nagpur of Nagpur district. We are
taken soil samples from ten different regions of Nagpur. After measuring the soil samples pH values we stored it into one database. Total Eighty soil samples were analyzed and camera (minimum requirement: 5megapixel) Used for capturing images (Generally JPEG format). The format of images was converted into image file for getting digital value and finally determined their digital values of pixels. Those pixel values can give us RGB value of each Image File by using digital image processing.

We are using MATLAB 7.0 as software for Digital Image Processing. Firstly we took 80 Soil pH values and calculate their soil pH factor (index) and stored both in Row Vector (database). Soil pH factor (index) of each sample can be calculated as:

A. Soil pH factor (Index) \[ \frac{(AVG G/AVG B)/AVG R} \]

Now To calculate pH value for new soil sample first we capture the image of soil then by using the formula of Soil pH factor (index) we calculate the new factor of new image. The image capture in the system can be taken as matrix of pixels associated with combination of red, green and blue values. The average of each sector can be used to calculate the Single soil pH factor value for each image.

As we have only few samples pH values and their calculated pH factors (index), so we can add +0.01 and subtract -0.01 to get the approximation in the results. Then compare the new value with values which is already stored in the database which is in particular range return the Soil pH factor and according to it we return the Soil pH value of new soil sample.

We collect some documents from Government Soil Testing Lab, Agriculture College Nagpur regarding the pH values of soil and the plants which grow in that values range are as shown below:

By using this table we not only give the Soil pH value of Soil sample but also the type of the soil, the deficient nutrient present in the soil range and the type of plant suitable for the soil. So we provide the complete report of testing soil to the farmer or user.

V. RESULT AND DISCUSSION

The image capture by camera is in the form of matrix of values when we take image by using RGB function present in the MATALAB. MATLAB detect value and calculate the values by using predefined functions. The image of any object has corresponding combination of red, green and blue values. Generally we derived the composite image of three color from original image data. The digital values and their correlations help to associate with real time soil sample. The Software calculates Soil pH value within the range by using the approach of deriving new value from existing value. The manually calculated value of soil pH by pH meter is shown in figure1 with its original pH values.

![Fig. 1: pH value=6.6](image1)

The same soil sample image is captured by using the camera and upload in the software. The result calculated as soil pH value by digital Image processing. So the soil pH value calculated of same soil sample is show in figure2.

![Fig. 2: pH value=6.8](image2)

VI. DISCUSSION

We have done experimentation on storing pH values of seventy soil sample in database. In the application if we want to calculate pH value then select image of soil sample which we want to test. Then after select image of soil it will give the soil approximate pH value within range automatically rather than testing manually.
The pH value calculated by software is slightly differing than tested value by pH meter. The process of manually testing soil if not taken properly the it also affects original result. So the software gives the result of 60%-70% in accuracy. We also provide the report of tested soil with type of soil, deficient nutrient present in the soil as well as it suggest the suitable crop for the soil on the basis of pH value.

REFERENCES


A. Web References
[1] www.mathwork.com