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Detection of NPK Ratio Level Using SVM Algorithm And Smart Agro Sensor System

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Abstract: Soil plays a major role in any plant growth .Soil properties such as Soil type, Fertilizers, pH of soil, Temperature, Humidity, Moisture are major factors which affect the crop growth .For continuous monitoring of these factors and getting accurate results modernizing the current traditional methods of agriculture is necessary. Hence Project aims at making agriculture smart using automation, image processing and Internet of things. This paper introduces a system which gives the details of all necessary soil factors to the farmer in a mobile app. The highlighting features of this system includes detection of NPK ratio using image processing SVM algorithm .Secondly automatic irrigation using soil moisture sensor .Thirdly environmental factors monitoring which includes temperature ,humidity ,pH sensors . By knowing these factors farmer can decide the best crop to be grown, monitor and maintain the plant growth for the better yield.

Keywords: NPK detection using SVM algorithm, automatic irrigation, temperature, humidity, pH sensor, Internet of things.

I. Introduction

India is agriculture backboned country. Agriculture plays a key role in the growth of country's economy. Soil is one of the most valuable resources in this field. Testing of soil is very much important in this regard for selection and maintenance of crop. Though there are soil testing laboratories but there availability is very low and unfortunately many farmers skip this process for this reason or do this process only once and repeatedly grow the same crop. Also, once planting is done it should be monitored and maintained with proper environmental factors needed for the crop. Hence there is need to implement modern science and technology in this field for increasing the yield.

This paper therefore proposes a system which is useful in monitoring the field data and detecting the NPK level ratio in the soil. As the crop selection depends on the nutrients ratio present in the soil and Nitrogen phosphorous and potassium are the major fertilizers in the soil, detecting the ratio level of NPK is very important.

Paper acquaints one productive approach with identify the NPK estimations of the soil using image processing technique. The proposed approach comprises of three principle stages; to be specific pre-processing, feature extraction, and classification phases. Since the color, texture and shape characteristics are a standout amongst the most critical components that depict soil, the proposed framework utilizes Gray-Level Co-event Matrix (GLCM) for distinguishing and recognizing soil state. Support Vector Machine (SVM) algorithm with different kernel functions is utilized for grouping stage or classification. Datasets of few processed soil pictures were utilized for both training and testing stages. Rapitest was used for cross validation. Experimental results demonstrated that the proposed arrangement approach has acquired good esteem exactness.

This NPK values along with the soil moisture, pH, temperature and humidity values from sensors are updated when required to the Farmer using android application

II. Proposed system

The main goal is to integrate a sensing module with a Image processing setup to monitor the essential details needed for plant growth from the soil.

The proposed System has 3 main modules
a) Sensing module
b) Communication module
c) Soil Image processing to detect NPK ratio

BLOCK DIAGRAM

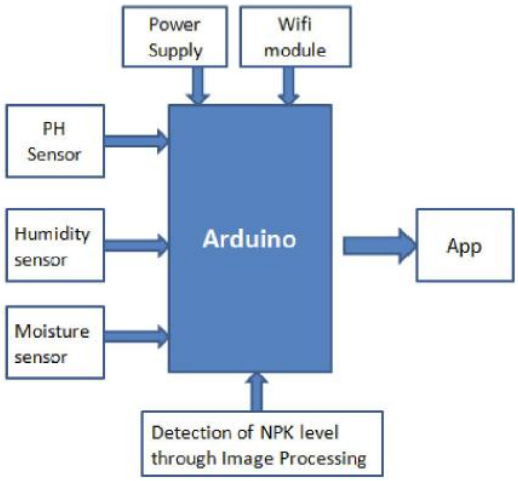

Fig 1.Block Diagram of proposed work

❖ **Sensing Module**

The sensor nodes measures the values and gives it to microcontroller for processing as per datasheet logs

A. Microcontroller (Arduino Mega 2560)

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button

B. Soil Moisture Sensor

Soil moisture sensor measures the water content in soil. It uses the property of the electrical resistance of the soil. Here, It is used to sense the moisture infield and transfer it to microcontroller in order to take controlling action of switching water pump ON/OFF.

C. Temperature/Humidity sensor

Fig 2: DHT11 Sensor

The DHT11 is a basic, low-cost digital temperature and humidity sensor. It gives out digital. It has a capacitive sensor for measuring humidity. The only real shortcoming of this sensor is that one can only get new data from it only after every 2 seconds.

D. pH analog meter

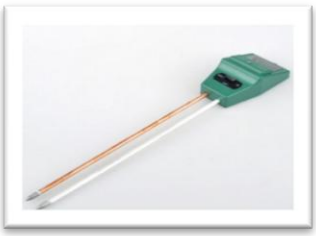

Fig 3 pH Sensor

❖ **Communicating Module**

The sensed data along with NPK ratio level is sent to a app through accessed by internet using Wi-Fi module

E. Wi-Fi Module (ESP8266)

ESP8266 is a highly incorporated chip intended for the necessities of newly associated world. ESP8266 can be used to connect to a host application and also to offload it to a WI-FI networking. It uses AT commands to communicate with other connected devices.

Fig3:ESP8266

F. Blynk App

Blynk was designed for the Internet of Things. Hardware can be remotely controlled also it can store ,display and visualize the sensor data and do many other things.

❖ **Soil Image processing to detect NPK ratio**

To complete the life cycle of soil plants need more than 17 nutrients such as C, H, NPK, Mg, Ca, S etc. Among these Nitrogen, phosphorous and potassium are the major components .Detecting the ratio of these and maintaining them in soil is very much essential for plant growth.

Nitrogen: It is essential because it is Responsible for Rapid foliage growth and green colour, easily leaches from soil. It depends on RGB analysis and Porous texture of soil
Phosphorous: Promotes Root formation and growth. Soil gets slightly Bluish in its presence
Potassium: Helps plants overcome drought stress, improves disease resistant. Yellowish blue, presence of ores are seen in soil.

A. Earlier method

The traditional method of estimating the NPK level Rapidest method in which the moisturized soil is put inside a container to match the colour and find out the level of nitrogen, phosphorous and potassium. The idea is to estimate the colour of soil to find the NPK level. Only colour feature gives less accuracy .Adding Texture and shape along with colour will improve efficiency of output.

B. SVM Algorithm

Support Vector Machine (SVM) is an algorithm used for Data Classification. Classification is done in two phases i.e, Testing and Training Phases. Each sample in training set contains one class label and several attributes

C. Methodology

Image Acquisition, enhancing the image using Grey scale analysis, Adaptive Histogram analysis and feature extraction is done and stored in GLCM matrix.
For detecting the ratio level the 13 feature characteristics are used
Colour: Mean, Skewness, kurtosis;
Shape: Eccentricity, Extent, Solidity
Texture: Contrast, Correlation, Energy, Homogeneity

These feature values are analysed with comparison with database feature extraction and Multisvm is used to classify into ratio level of NPK indicating which
Nutrient is low
This value is forwarded to microcontroller serially.

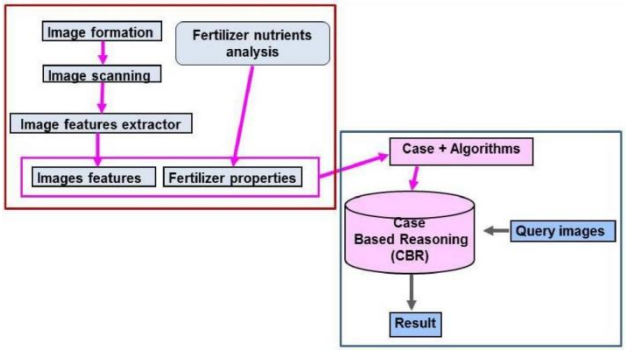

Fig 4:Flow Diagram

III. Results And Discussion

The practical output obtained is same as the expected result, Smart Agro system which monitors the plant growth factors is able to perform the following features successfully.

- Gives moisture level(dry/wet) of soil, humidity reading, and pH scale value Fig5.

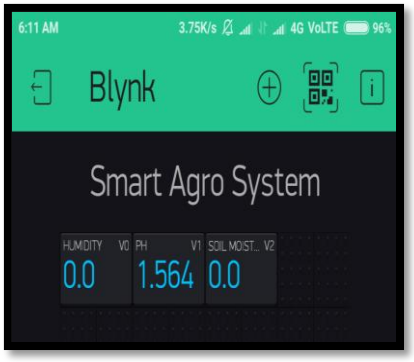

Fig5: app layout

- Soil image is processed for image enhancement (Fig 6)

Input Soil image **Grey Scaled Image** **Adaptive Histogram analysis**

- After extracting all the features from GLCM matrix i.e, Color , Shape and texture characteristics the ratio of NPK is detected.
- Sends information about this level to the app

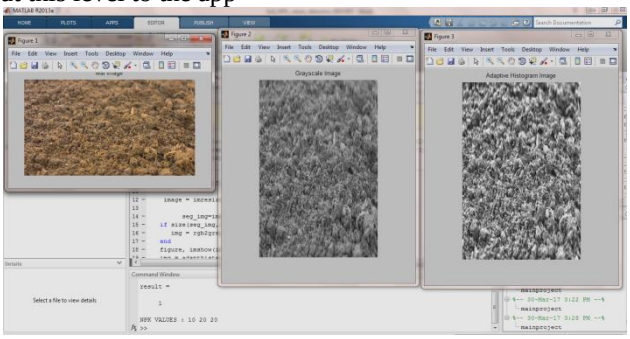

Fig7: Results obtained after analysing the soil input

- Based on these result farmer can monitor and take measurements to maintain the facors affecting the plant

IV. Future Scope

- Upgrade the result of NPK ratio to NPK quantity detection
- Building a mobile app which interconnects all the farmers and includes all the details needed about plant growth and Marketing of equipments and fertilizers.
- Use of WSN, Solar energy concept

V. Conclusion

This project proposed a soil image pattern classification to identify NPK with a combination of texture and colour feature extraction. Images are classified by support vector machine classifier. A combination of several features is used to evaluate the appropriate features to find distinctive features for identification of soil NPK.

Also the environmental Factors i.e. Moisture, temperature/humidity, pH values from sensors are also updated to the farmer.

VI. Acknowledgement

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