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Crop Yield Estimation

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ABSTRACT

Agriculture is the important sector in our country, in order to meet the increasing population demand we have to increase the crop yield. The production of agriculture has to be improved to maintain the sustainable balance. The sustainable production of crop mainly depends on various factors such as environment, climate, water, soil, etc. More than 70% of the population is involved directly or indirectly in crop production activities. This paper provides a quick summary of the uses different sensors for acquire the data to measure various environmental factors which are required for crop production. The developed system is capable of monitoring temperature, humidity, soil moisture level using Node MCU and several sensors connected to it.

KEYWORDS: Agriculture, Sensors, Cultivation, Soil Parameter, Temperature

1. INTRODUCTION

The technology has seen many phases from doing all work manually to farmers depending upon sensors and machines to do almost all the work and do it even effectively. Today's agriculture generally uses refined technologies like robots, temperature and moisture sensors, and lots of complex IOT devices. These advanced devices in agriculture enable businesses and farmers to be additional profitable, efficient, safer, and more environmentally friendly.

The rise of digital agriculture and its connected technologies has opened a wealth of latest knowledge opportunities. Remote sensors, cameras, and alternative connected devices will gather data twenty-four hours per day over a complete farm or land. These will monitor plant health, soil condition, temperature, humidity, etc. the quantity of information these sensors will generate is overwhelming. This enables farmers to achieve a far better an improved understanding of state of matters on the bottom through advanced technology which will inform them additional regarding their situation more accurately and quickly.

The environmental data that is gathered by remote sensors are processed by algorithms and statistical data which will be understood and helpful to farmers for decision makings and keep track of their farms. The more inputs and statistical data collected and higher the algorithmic rule is at predicting the outcomes. And the aim is that farmers will use these technologies to attain their goal of improved harvest by creating better selections within the field.

As India is the land of agriculture, the cultivated crops will not always be healthy. In order to increase the productivity and decrease the disease from the crop leaves needs monitoring of crop required frequently.

Diseases in crop affect heavy loss of the production. So the disease needs to be identified at the initial stages and suggesting farmers to keep crop away from the harm in the production of the crop to increase the yield. The proposed work highlighting on segmentation and classification of the disease discussed above automatically. Our system automatically detects leaf diseases using k-mean clustering. Our system provides a high-speed, accurate and inexpensive method in detecting and classifying leaf diseases.

2. PROPOSED SYSTEM

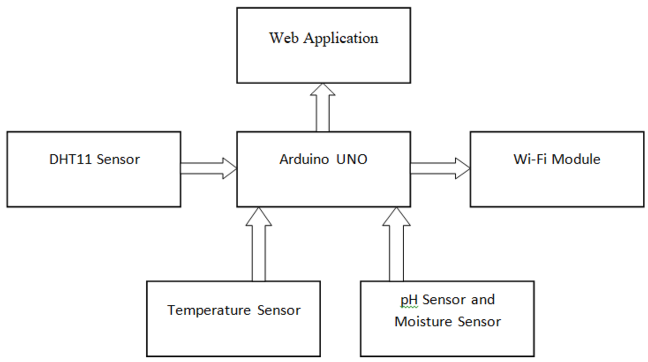

Fig 1. Module 1

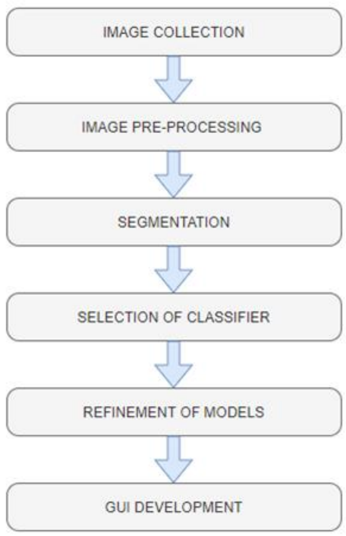

Fig.2 Flow chart of proposed algorithm

3.WORKING PRINCIPLE

Module 1:

Step 1: initialize the NodeMCU, temperature and humidity sensor (DHT11).

Step 2: connect the NodeMCU to the internet via WIFI.

Step 3: The NodeMCU reads the data sent by the sensor.

Step 4: The NodeMCU processes the sensor data, send it to database and sends sensor reading to php webpage.

Step 5: Smartphones, tablets, and computers read data from the server.

Module 2:

Step 1: Input the plant images that may contain disease.

Step 2: Median filter is imposed thus removes various noises from imaging.

Step 3: Apply Contrast stretching technique (as discussed in section) to improve the contrast of noise free image.

Step 4: Applying K-mean Clustering technique on image converted into L*a*b* color model, the initial number of clusters K is chosen as 5.

Step 5: After the K-means clustering all clusters are converted into HSV color model and a cluster that contain disease is segmented by analyzing maximum mean hue value among all clusters.

Step 6: Color and texture features are extracted from the segmented cluster.

Step 7: Test on the features extracted from above cluster and determine whether the plant image belongs to healthy or not and if not, then classify various class based on various diseases on crop images.

A. Dataset Collection

Training data for machine learning (ML) is an important input of algorithms that remember information to understand such data and predict the future. During the development of the ML there are various factors that cannot be accomplished without various important tasks. We have used CNN i.e. Convolution Neural Network to train our datasets.

B. Image Preprocessing:

Images are resized to smaller pixel size in order to speed up the computations of data. The noise is removed using some filtering techniques like Gaussian Blur. RGB format is unable to separate image intensity.

So it is then converted to another color space that is HSV which separate color from intensity.

Fig.3 Images after Preprocessing

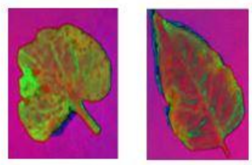

Fig.4 Images converted to HSV color space

C. Segmentation:

Segmentation in our image processing is performed using K-means clustering with 2 cluster centers. After finding the two clusters, one with background and other one with leaf part, the clustered image is used to change the pixel value of the background of the leaf to black. By doing so the useless information from the image is eliminated this in turn increases accuracy.

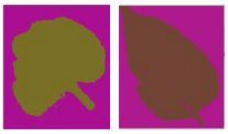
Fig. 5 Images after K-means clustering


Fig.6 Images after removal of Background

Refinement of CNN Model:

The dataset has been increased to 52,000 images in order to capture more plant leaf diseases. Due to increment of dataset there are now 38 total classes to classify. The CNN model has to be good enough to capture all complex patterns. The Convolutional Layers hence increased to 6, units in last Dense layers are now 38.

GUI Development:

We have used Qt designer tool to design the basic structure of GUI then we combine our functions to the respective buttons.

4.MATERIAL AND METHODS

We are using PH sensor, Temperature Sensor, Moisture Sensor, the Node MCU for this project.

A. Soil Moisture Sensor

The Soil Moisture Sensor measures soil moisture grace to the changes in electrical conductivity of the earth (soil resistance increases with drought). Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners to take out the data we require.

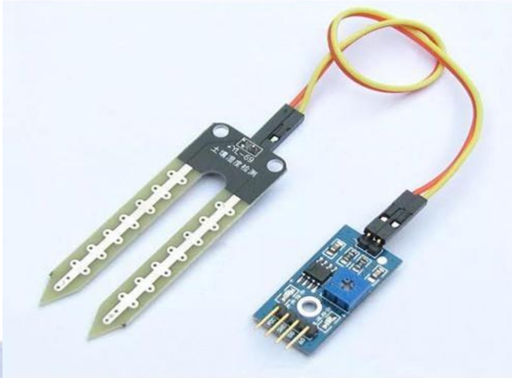
Fig. 3 Soil Moisture Sensor

B. pH Sensor

The pH Moisture sensor is designed for simplicity of use with accurate results. It is an economical way to test for moisture and pH levels in the soil. This sensor doesn't need any battery and works well for vegetable/ flower garden, perfect for growing vegetables, fruits, flowers etc. This soil pH tester can measure soil moisture, pH values and sunlight intensity, helps you know when to water, adjust the pH value and know whether your plants gets adequate sunlight. This sensor proves to be very helpful for you to plant flowers, plants and make them grow healthy and strong.


Fig. 4 pH Sensor

C. Node MCU

The Microchip Technology devices provide successive approximation of 12-bit Analog to Digital (A/D) Converters with on-board sample and hold circuitry. The MCP3204 is programmable to provide two pseudo-differential input pairs or four single ended inputs. The MCP3208 is programmable to provide four pseudo-differential input pairs or eight single ended inputs. Communication with the devices is accomplished using a simple serial interface compatible with the SPI protocol. Low current design permits operation with typical standby and active currents of only 500 nA and 320 µA, respectively. The MCP3204 is offered in 14-pin PDIP, 150 mil SOIC and TSSOP packages. The MCP3208 is offered in 16-pin PDIP and SOIC packages.

Fig. 5 Node MCU

D. DHT 11 sensor:

This DHT11 is temperature sensor offers an in tuned to highly developed sign yield for the heat Also temperature sensor proficiency. It will be synchronized circuit with a high-octane 8-bit microcontroller. Its engineering ensures the fidelity also phenomenal high power. This sensor incorporates a resistive component and sensor to wet the NTC temperature measuring gadget.

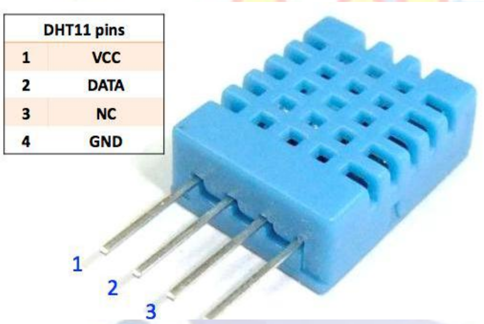

Fig. 5 DHT11 Sensor

5. SYSTEM IMPLEMENTATION

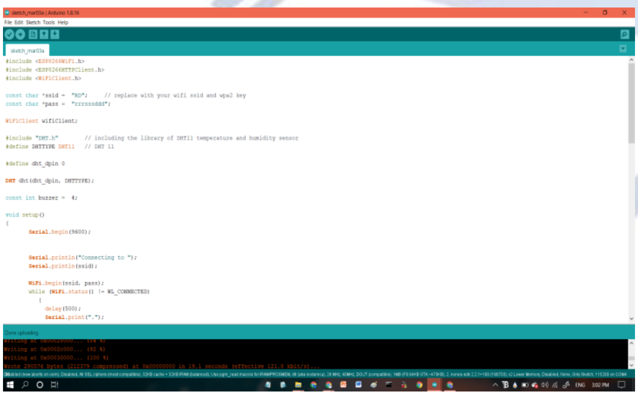

Fig 6

In fig. 6, we are looking at Arduino program which will connect all sensors with Wi-Fi module and then we are going to take inputs such as temperature, humidity and pH of the soil and then we are going to feed it to our database.

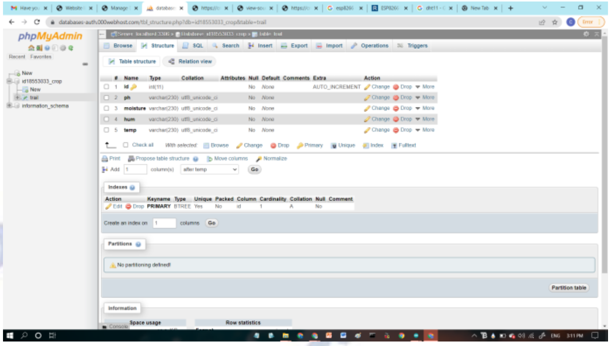

Fig 7

Here we have created a database which will contain attributes such as pH, moisture, humidity and temperature that we are going to add with the sensors. The information will be taken each time at specified interval and will be stored in the database.

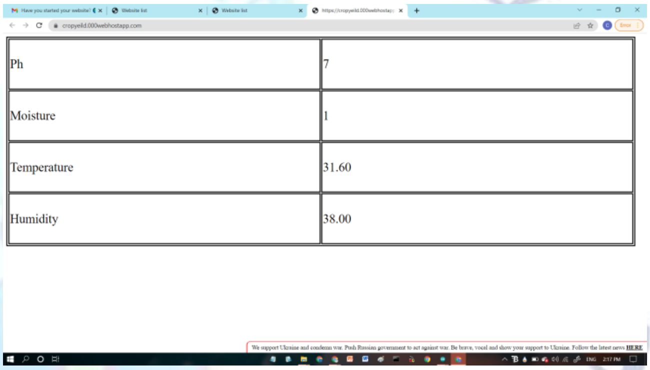

Fig 8

We are going to use information from our database and using php we are going to render this information onto our webpage. The information here also will be updated at certain time of interval.

Fig 9

Fig 9 and 10 are for plant disease prediction, here we are going to provide the image of our plant leaf which will then be processed and then identify if plant is infected or not.

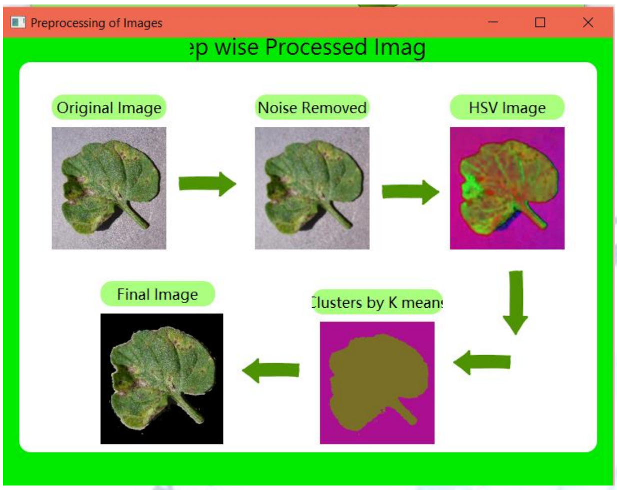

Fig 10

6.CONCLUSION

Agriculture is gradually being replaced and enhanced by more upgraded and correct digital and electronic device. A high amount of agriculture revenue is lost to power loss, incorrect methods of practicing. This is reduced by the use of smart sensors. The proposal is to perform the agriculture in smart and more efficient way. In addition, this method advocates for the use of the IoT. IoT need enabled the farming worker crop checking not difficult Also proficient should improve those benefit of the crop and henceforth benefits to the rancher. Sensors for distinctive sorts are used to gather information the majority of the data of crop states and Ecological transforms and this data will be transmitted through organize of the farmer/devices that initiate restorative activities. Farmers are associated and mindful of the states of the agriculture field in anytime and anyplace in the world

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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