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Smart Water Management & Intelligent Farming

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ABSTRACT

Agriculture is the primary occupation in our country for ages. But now due to migration of people from rural to urban there is hindrance in agriculture. So, to overcome this problem we go for smart agriculture techniques using IoT. This project includes various features like remote controlled monitoring, moisture and temperature sensing, security, leaf wetness and water management facilities. It makes use of wireless sensor networks for noting the water level and environmental factors continuously. Various sensor nodes are deployed at different locations in the farm. Controlling these parameters are through any remote device or internet services and the operations are performed by interfacing sensors, Wi-Fi, camera with microcontroller. This concept is created as a product and given to the farmer's welfare.

Keywords: agriculture, IoT (Internet of Things), water management, sensors, remote device, internet services.

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I. INTRODUCTION

India being an agricultural country is still using traditional ways of recommendations for agriculture. Currently recommendations for farmers are based on one to one interaction between farmers and experts and different experts have different recommendations. Recommendation can be provided to farmers using past agricultural activities with help of data mining concepts and the market trend can be merged with it to provide optimized results from recommended. The paper proposes the use of data mining to provide recommendations to farmers for crops, crop rotation and identification of appropriate fertilizer. Intelligent farm surveillance system is for viewing the remote farm. In traditional video surveillance model the basic disadvantage is manual detection of the event. Many developed and developing country are using intelligent farm surveillance system for viewing the farm remotely. In this paper there is a brief survey of different object detection techniques, frontal and profile face our system is being proposed in order to make the data set more accurate, labeled and efficient enough to provide it as an input to the machine learning algorithm. The need of supervised data in today's world is increasing rapidly. As the organizations cannot always afford for domain experts, lots of processing time and manual effort.Manual intervention may also lead to errors in the dataset. Hence the need emerged to provide a automatically labeled dataset. We proposed a system in order to overcome all these issues and convert the unlabelled dataset into labeled dataset automatically by Creating probabilistic labels for the input data. The main aim of this paper is to propose a state of art wireless sensor technology in agriculture, which can show the path to the rural farming community to replace some of the traditional techniques. In this project, the sensor motes have several external sensors namely leaf wetness, soil moisture, soil pH, atmospheric pressure sensors attached to it. To also recommend the farmers about the crop to be grown based on farmer and agricultural database stored on cloud. Intelligent video surveillance systems deal with the real-time monitoring of persistent and transient objects within a specific environment. The primary aim of this system is to provide an automatic interpretation of scenes and to understand and predict the actions and interactions of the observed objects based on the information acquired by video camera.

II. MATHEMATICAL MODEL

Water Management:
Area of Rectangle:
$A, ft2 = L * W$ Circle: $A, ft2 = 0.785 * D2$ Volume of Rectangular Tank:

V, ft3 = L * W * H FLUORIDATION
AFI = Molecular Weight of Fluoride
Total Molecular Weight of Chemical * (100) Feed Dose, mg/L =
Desired Dose, mg/L – Actual Concentration, mg/L

Mixture Strength, % =
(Tank, gal)(Tank, %)+(Vendor, gal)(Vendor, %) Tank, gal + Vendor, gal
For Saturator
Feed Rate, gpd = Capacity, gpd * dose, mg/L
18,000 mg/L
Pumps & Motors:
Water, whp = (Flow, gpm)(Total Water Head, ft)
3,960
Brake, bhp = (Flow, gpm)(Head, ft.)
(3,960)(Decimal Pump Efficiency) Motor, mhp = (Flow, gpm) (Head, ft.)
(3,960)(Decimal Pump Efficiency)* (Decimal Motor Efficiency)
Total Dynamic Head, ft = Static Head, ft. + Friction Loss, ft.
Cost = Motor, hp * .746 kW * Cost * Hrs. * Days

Leaf Disease detection using image processing:

1. Image acquisition is the very first step that requires capturing an image with the help of a digital camera.
2. Pre-processing of input image to improve the quality of image and to remove the undesired distortion from the image. Clipping of the leaf image is performed to get the interested image region and then image smoothing is done using the smoothing filter. To increase the contrast Image enhancement is also done.
3. Mostly green colored pixels, in this step, are masked. In this, we computed a threshold value that is used for these pixels. Then in the following way mostly green pixels are masked: if pixel intensity of the green component is less than the pre-computed threshold value, then zero value is assigned to the red, green and blue components of the this pixel.
4. In the infected clusters, inside the boundaries, remove the masked cells.
5. Obtain the useful segments to classify the leaf diseases. Segment the components using genetic algorithm
For doing clustering appropriately, the search capability of GAs can be used, to set of unlabeled points in N-dimension into K clusters. On image data, we have applied the same idea in our proposed scheme. We have taken a color image of size m × n and every pixel has Red, Green and Blue components. Every chromosome shows a solution, which is a sequence of K cluster centers. Population is initialized in various rounds randomly and from existing chromosome best chromosome survives in each round for the next round processing. In the first step of fitness computation the dataset of pixel is clustered according to nearest respective cluster centers such that each pixel xi of color image is put into the respective cluster with cluster center zj for j = 1, 2, …, K by the following equations
If
||xi-zj||<||xi-zl||, i=1,2,⋯,m×n,l=1,2,⋯,K,andp≠j.

In the further step new cluster centers are obtained by calculating the mean of each pixel of the assigned clusters. The new center of cluster Zi is given by for the cluster Ci As:
Zi(r,g,b)=1ni∑xj∈ci(xj(r,g,b))i=1,2,⋯.k
Now the fitness function is computed by calculating
Euclidean distance between the pixels and their respective cluster by using following equations:
M=∑Mi
Mi=∑xj∈ ci(xj(r,g,b)-zi(r,g,b))
6. Computing the features using color co-occurrence methodology for feature extraction the method used is color co-occurrence method. It is the methodology in which both the texture and color of an image are considered, to come to the unique features, which shows that image.
Over the traditional gray-scale representation, in the visible light spectrum, the use of color image features provides an additional feature for image characteristic.
There are three major mathematical processes in the color co-occurrence method. First, conversion of the RGB images of leaves is done into HIS color space representation. After completion of this process, to generate a color co-occurrence matrix, each pixel map is used, which results into three color co-occurrence matrices, one for each of H, S, I.
Features called as texture features, which include Local homogeneity, contrast, cluster shade, Energy, and cluster prominence are computed for the H image as given in Eqs. 4,5,6,7.
CONTRAST= ∑ i,j=0N-1(i,j)2C(i,j) ENERGY= ∑ i,j=0N-1C(i.j)2
7. Local Homogeneity=∑I,j=0N-1C(i,j)/(1+(ij)2) Entropy=-∑i,j=0N-1C(i.j)log C(i.j) Classification of disease
In this phase of classification, extraction and comparison of the co-occurrence features for the leaves with the corresponding feature values are stored in the feature dataset. First, the Minimum Distance Criterion and then SVM classifier are used to done the classification. The measurement of success of classification is done by using the classification gain and following Eq. (8 is used for calculation:
8. Gain (%) = number of correct classification/Total no of test images.

III. METHODOLOGY

Various sensors are deployed in the field like temperature sensor, moisture sensor and PIR sensor. The data collected from these sensors are connected to the microcontroller through RS232. In control section, the received data is verified with the threshold values. If the data exceeds the threshold value This alarm is sent as a message to the farmer and automatically the power is switched OFF after sensing. The values are generated in the web page and the farmer gets the detailed description of the values. In manual mode, the user has to switch ON and OFF the microcontroller by pressing the button in the Android Application developed. This is done with the help of GSM Module. In automatic mode, the microcontroller gets switched ON and OFF automatically if the value exceeds the threshold point. Soon after the microcontroller is started, automatically an alert must be sent to the user. This is achieved by sending a message to the user through the GSM module .Other parameters like the temperature, humidity, moisture and the PIR sensors shows the threshold value and the water level sensor is used just to indicate the level of water inside a tank or the water resource.

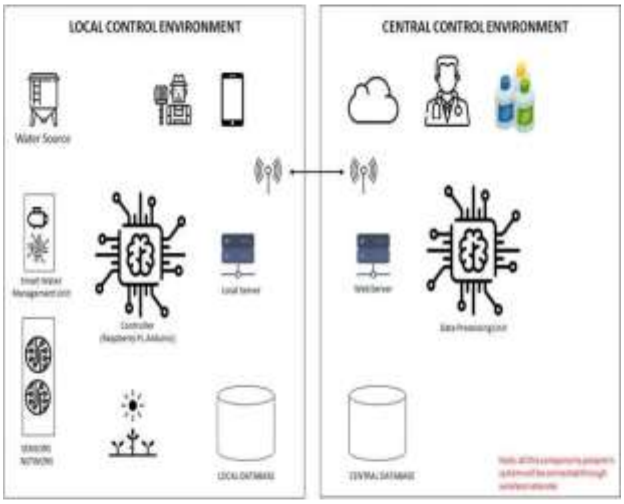

Figure 1. System Architecture

IV. EXPERIMENTAL RESULTS

The Results from the Table-1 represents the algorithms having different accuracies for leaf diseases detection. Local Binary Patterns shows accuracy of 77.55% which is not efficient for detection purpose. Principle Component Analysis method gives accuracy of 80% this can be used for datasets having good frontal images. Haar Cascade Classifier is famous algorithm and gives a accuracy of 92.9% and it can be used in place of CNN if there is no GPU in Computers. The Multiple tests have shown the accuracy of 99.38% consistently for CNN. The system has shown correct results in low light conditions, in cases where target leaf is at a certain angle to the mounted camera and also in video frames with low pixel density. Even when the leafs are slightly blur it shows good accuracy. The time-frame captured during the leaf detection. Optical Character Recognition is also performing efficiently. This will help to understand how much the leaf health is good and how much the leaf health is affected due to environmental and pesticides. These results will help the farmers to understand the leaf condition and suggest the required pesticides. This is very useful in analyzing the leaf health as well as its increases the productivity of farming.

Algorithms	True Positive	False Positive	Accuracy
LBPH[28]	76	34	77.55%
Eigenfaces[29]	85	15	85%
PCA [30]	78	22	80%
Haar Cascad e [31]	87	23	92.9%
Proposed System using CNN	89	11	95%

Table 1 Confusion Matrix

V. LITERATURE SURVEY

It reviewed the variations of WSNs and their potential for the advancement of their various agricultural applications for the improvements. Features the main agricultural and cultivating applications, and examines the appropriateness of the WSNs towards improved performance and profitability.It groups of system architecture, node architecture, and a communication technology norms utilized in agricultural applications.

The real world wireless sensor nodes and a different sensors such as soil, environment, pH, and, plant-health are likewise listed. It present a thorough review of the state-of-the-art in WSN sending for advanced agricultural applications.

It will represent the system and node architectures of WSNs, and the related factors, and a classification according to the distinct applications. It overview the different available wireless sensor nodes, and the various communication methods followed by the senodes.

Precision Agriculture (PA) utilized WMSN to enable proficient irrigation. It depict about IoT and WMSN in agriculture applications. It can be explained and demonstrated the efficiency of feedback control technique in crop irrigation. A test was led to see the distinctive these two strategies. The techniques are irrigation by schedule or feedback based irrigation. Irrigation by schedule is to supply water to the plant at explicit time-spans. Feedback based irrigation is to irrigate plant when the moisture or level of media wetness came to predefined esteem.

WSN is an alternative and efficient approach to solve the farming resources optimization and decision making. Precision agriculture systems dependent on the internet of things (IOT) technology is explained in detail particularly on the hardware and network framework and software process control of the exactness of irrigation system. The system collect analyze and monitors information from the sensors in a feedback loop which activates the control gadgets based on pre-determined threshold value. Finally, smart farm management which incorporates temperature maintenance, humidity maintenance in the farming are. Controlling of every one of these operations by using any remote smart gadget or computer connected to Internet and the tasks will be performed by interfacing sensors, actuators with micro-controller and raspberry pi.

VI. CONCLUSION

The system being proposed here can help farmers in sowing the right seed based on soil requirements to increase productivity and acquire profit out of such a technique. We also proposed the use of data mining techniques to provide recommendations to farmers for crops, crop rotation and identification of appropriate fertilizer. Thus the farmers can plant the right crop increasing his yield and also increasing the overall productivity of the nation. Intelligent farm surveillance system refers to the video level processing techniques for identification of specific objects, in recorded videos of the farm. In our work, we have assumed video, to be a series of images and have extended the concept to identify birds from videos of the farm.

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