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Smart Agricultural Surveillance through Image Processing

Mrs.V. Padmajothi[1], Shreyash Gupta [2],
Manish Kumar Gupta[3],Amit Kumar[4]
[1,2,3,4]Dept. of Electronics and
Communication Engineering
SRM Institute of Science and Technology
Chennai, India

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Abstract

India ranks second worldwide for its agricultural yield and due to the various climatic condition that prevails, huge variety of crops and plants grow here. Our agricultural fields carry an average of 9 billion gallons of freshwater every day. The biggest problem in Indian agricultural system is that although the agriculture is the backbone of the country, the irrigation facilities in India are not up to the mark. In this paper, we propose and overcome the constraints of the conventional irrigation system and will developa model based on an automated irrigation system that can sense the soil moisture, process wirelessly, and activate its own water supply. The land on which the crops are grown can be monitored using image processing method and that data will be stored in IoT. Apart from that, external sensors are used to monitor the soil exact status.

***Index Terms*:**Image Processing, K-means clustering, Segmentation, Land Recognition.

1 INTRODUCTION

Rainfall is the need of an hour to get good agricultural yield and most of the farmers in India depend upon rainfall rather than any other irrigation facilities. Due to the insufficient spread of irrigation facilities, many farmers are unable to adopt the HYV seeds. Even after about 60 years of planning, Indian agriculture is highly monsoon-dependent. About 40% of the total agricultural land is irrigated, which means that though agriculture is the prominent occupation in India, the Indian government is inefficient in investing in the modern irrigation facilities. However, poor irrigation scheduling and inefficient utilization of water resources are two defined parameters that plays a negative role in the agricultural production.

The data collected such as humidity level, temperature level can be used to avoid the crops from being damaged and modify irrigation schedules. For example, water level sensors can be used to calculate the soil moisture and humidity in grams per cubic meter and the result of the same will be shown on LCD. The temperature sensors calculate the temperature of the ground and soil and activates the water supply if the temperatures value is above certain degrees. These sensors work in conjunction with the water supply unit and prevents the unnecessary wastage of water and drying of land. The Image processing unit captures the image of the land and based on its humidity, renders the output wet and dry which when dry activates the water supply with the help of pump motor thus watering the crops at correct time and increasing productivity. This real-time data of soil condition and crop features can help farmers to make timely decisions of which crops to be planted where and when, also the correct time to plough them. The large amount of data will then be stored in IoT (Internet of Things) and will help farmers to keep a record of it.

2 DESIGN METHODOLOGY

The Design Methodology of the Smart Agricultural Surveillance through Image Processing involves Several stages. The Project Flow Diagram (Fig.1) describes the different stages involved in reading the image captured and then displaying the result based on the dryness of land for having the pump motor switched on.

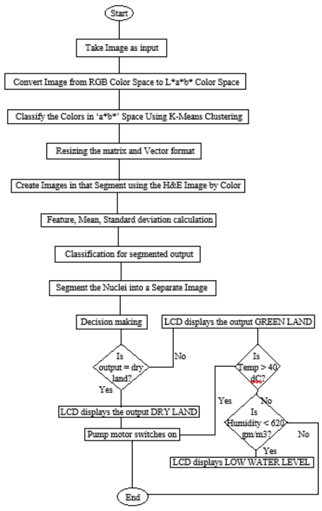

Fig.1. Project Flow Diagram

A. Image Processing

Input land images are captured using Pc webcam and images are acquired through Matlab programmedwith clustering algorithms.

B. Colour Conversion

Three colours are seen in the image when all the variations in the brightness are ignored: white, blue, and pink. These colours can be visually distinguished from each other. The L*a*b* colour space quantifies these visual differences.The L*a*b* colour space consists of a luminosity layer L* chromaticity-layer a* which indicates where the colour should fall along the red-green axis, and chromaticity-layer b* which indicates where the colour should fall along the blue-yellow axis. The a* and b* layers have the colour information. The Euclidean distance metric can be used to measure the distance between the two colours.

C. Clustering

Clustering generally means to separate the group of objects from each other. K-means clustering signifies every object as it has a location in space. Along the partition the objects within each cluster should be as close to each other as possible and as far from the objects in other clusters. The number of clusters to be partitioned are specified using k-means and the closeness of the two objects to each other can be quantified using a distance metric. The objects are pixels with a* and b* values.

D. Resizing

For all rows and columns there is a matrix in a particular channel 2 and 3. The rows and column size are calculated. Then resize the matrix and vector format for clustering purpose. Number of clusters have to get extracted in the input image are given and the clustering is repeated three times to avoid local minima.

E. Image Creation and Feature Calculation

Using pixel_labels, objects are seperated in hestain.png by colour, which will result in three images. Pre-memory allocate the after cluster segmented output for saving purpose then the label is given for identification of each cluster and then the feature is calculated. After then all mean and standard deviation features are combined and labelled. The segmented output is classified using SVM (Support Vector Machine).

F. Nuclei Segmentation

One of the clusters contain dark and light blue objects. TheL* layer in the L*a*b* colour space can be used to separate the dark blue objects from the light blue. After then, the extraction of the brightness values of the pixels in this cluster are made and are threshold using im2bw. As k-means doesnt returns the same cluster_idx value all the time, the blue objects in the index of the cluster can be determined programmatically. cluster_center value could be used for it, which contains the mean a* and b* value for each cluster.

G. Decision Making

The final stage of Image processing is decision making where the feature is extracted and predicted based on the image segmented and the colour difference of the image.

TABLE I. MATLAB CODE WORD AND OPERATION

he=imresize(b1,[512,512]);	Resizing of the input image for later uses.
imshow(he);	To show all the matrix values from the storing matrix.
cform=makecform('srgb2lab');	Making the colour conversion from RGB to Luminous blue and Yellow.
lab_he=applycform(he,cform);	Applying the colour conversion to the input image.
ab=reshape(ab,nrows*ncols,2);	Resizing the matrix and vectr formate for clustering
[cluster_idx, cluster_center] = kmeans(ab,nColours, 'distance', 'sqEuclidean', 'Replicates',5);	Clustering is performed for the center pixels which contains the mean values of objects for each cluster.
rgb_label=repmat(pixel_labels,[1 1 3]);	Labelling for identification of each cluster through repeating the fixed value of two matrices.
segmented_images{k} = colour;	Storing the colour in the two empty arrays(segmented_images) created.
t = fitcecoc(feature1,lab);	Classifying the input feature values.
classification{k} = predict(t,feat);	Predicting the features of different lands based on hyperplane.

The output is linked with the Arduino which indeed controls every device on the hardware set. The input image goes through a series of processing and the digital output for 1 and 2 as for dry and green land is fed to the Arduino through the serial in communication port MAX 232.

3 OUTPUT AND RESULTS

Land is captured as RGB colour image. The image undergoes Processing and features are extracted. Using the clustering algorithm (k-means) the image gets clustered and segmented thereafter to get the desired output.

The input image is shown as Fig.2 which gets recognized and then it is clustered as shown in Fig.3. The image gets segmented and after the feature extraction, the output is decided for dry and green land as shown in Fig.4 and Fig.5.

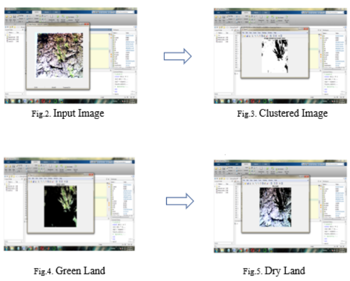

Fig.2. Input Image
Fig.3. Clustered Image
Fig.4. Green Land
Fig.5. Dry Land

Image Processing stages

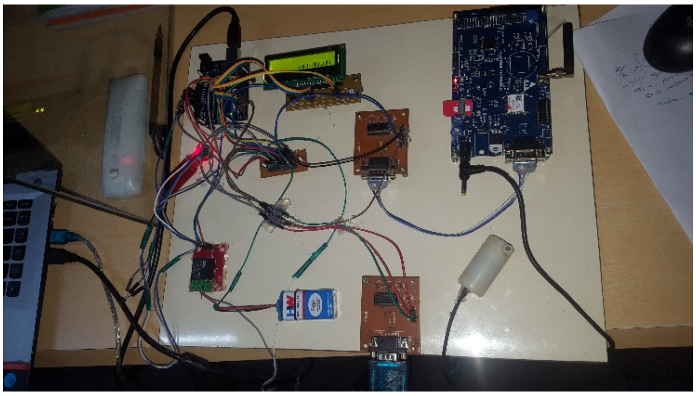

Fig.6. Hardware Circuit

As a result, the pump motor gets on if the land is detected dry which is controlled by the Arduino and the data gets stored in the IoT (Internet of Things) created URL. The setup for the same is shown in Fig.6. The two Transistor-transistor logics are basically to regulate the voltage value between Arduino IoT and Arduino Image Processing System. The relay is used which acts as an electrical switch to pump on the motor.

4 CONCLUSION

Fresh water is a non-renewable resource which should be used sustainably. The crops in India requires gallons of water everyday and to meet the demands, the irrigation facilities should be sound and available at the time. This system is usually designed to reduce the unnecessary wastage of water and to leverage the ubiquitous need of water in the areas where modern irrigation facilities are yet not developed. Apart from that it also reduces the manual labour of a farmer as it is automatically driven. The Image processing unit tells about the dryness of the land and the sensors senses the soil humidity and temperature which automatically starts the pump motor if the value falls below a certain threshold. Thus, we have developed a model that is completely automated right from image capturing, processing it for dryness, having switch on the water supply to storing the data in an IoT based URL.

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References

[1] Mehdi Roopaei, Paul Rad, Kim-Kwang Raymond Choo, Cloud of Things in Smart Agriculture: Intelligent Irrigation Monitoring by Thermal Imagining, IEEE Cloud Computing, Volume 4 Issue 1, 2017.

[2] Smart Agriculture using IoT and BPM. http://blog.auraportal.com/smart agriculture-using-iot-and-bpm.

[3] Colour based segmentation using K-means clustering. https://in.mathworks.com/help/images/examples/color-based-segmentation-using-k-means-clustering.html.

[4] www.iosrjournals.org

[5] Saad, N.H., N. Mohamad Sabri, A.F. Hasan, Azuwa Ali, and Hariyanti Mohd Saleh. "DefectSegmentation of Semiconductor Wafer Image Using k-Means Clustering", Applied Mechanics and Materials, 2015.