iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** V **Month of publication:** May 2017

DOI:

www.ijraset.com

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Volume 5 Issue V, May 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Innovative Way for Recognizing Nutrient Insufficiencies in Agricultural Crop Using Computer Vision

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Abstract: ***Many countries in the world are developing countries. Such developing countries' main revenue source is agriculture. Agriculture occupation has many problems like irregular water supply, increased temperature as well as extreme changing environment. Because of Less agricultural knowledge and less availability of agricultural expert, productivity of agricultural crop yield is decreased. To increase the productivity of agricultural yield, computer researchers are finding various techniques to solve agricultural problems using computer intelligence. Nutrient insufficiency is one of the problems which nutrient level if not satisfactory then crop self immune power decreases, results in crop got easily attacked by various disease and pest and reduce productivity as well as yield of crop. To find solution for nutrient insufficiency problem, we developed a computer vision system which takes input of nutrient insufficiency presented on leaf with image captured by smart phone camera. Interested leaf area is extracted by using canny edge detection algorithm. Using Euclidian distance between colors, color based segmentation performed on interested leaf part according to insufficiencies color characteristics. Color features are converted into discrete attributes. These features are passed to classification decision tree algorithm. After decision tree traversal, system recognizes nutrient insufficiency successfully. Experimental results of our system show that our system identifies nutrient insufficiency accurately and removes drawbacks of existing systems.***
Keyword: Smart phone application, computer vision, image processing, feature extraction, decision tree, nutrient insufficiency

I. INTRODUCTION

Agriculture is most important occupation of all the countries in the world. As the population of the world is increasing exponentially, to increase the agriculture crop yield became first priority of developing countries. Now, it is the era of computer technology, so many of researchers are analyzing agricultural problems to solve with computer intelligence.

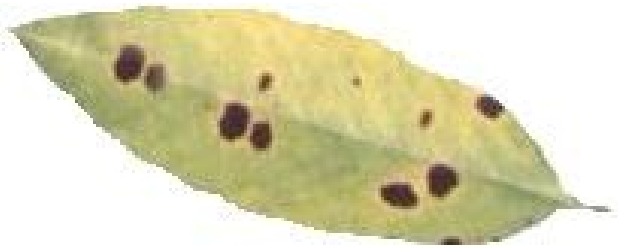

Fig. 1 Zink nutrient insufficiency

Nutrient insufficiency is one of the major problem in agriculture field due to which agricultural crop yield exponentially decreases and crop easily attached by various pests and insects and diseases. Any nutrient insufficiency shows specific visual symptoms on leaf of agricultural crop. Since agricultural field is very large and have large number of crop plants, it is difficult to analyze each and every plant by agricultural nutrient expert. Farmer is unable to analyze and recognize nutrient insufficiency as early as because of his knowledge and less experience. We solved this nutrient insufficiency recognition problem using image processing techniques and advanced data mining techniques.

Computer vision branch of computer science in which input is taken as visual i.e. image or video and using advanced image processing and data mining techniques image analysis is done and finds useful conclusions, facts. Today's era is smart phones.

Volume 5 Issue V, May 2017
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Smart phone many features like camera, global positioning system, internet, and most important processing capability. Smart phone can act as computer vision system so we use smart phone and android code for solving nutrient insufficiency recognition problem.

If we catch visual symptoms accurately then we can solve nutrient insufficiency problem. As an input we consider infected leaf. First we captured effected leaf of agricultural crop using android smart phone camera. Since smart phone have capabilities of processing, we build our nutrient insufficiency recognition solution in android language. Then using edge detection technique, we took only leaf area of that captured image. Remaining unwanted area is neglected. After getting interested region, we segmented that leaf image groups of color which characterizes leaves visual symptoms. Then we extract color percentage features for finding nutrient insufficiency. Then extracted features are classified using advanced data mining classification technique decision tree. Decision making is done using C4.5 decision tree algorithm. Our implementation accuracy is about 90%. In following parts of paper, we elaborate study behind this problem solving i.e. literature survey, algorithms used and results with analysis.

II. LITERATURE SURVEY

As food is main source of energy for human being, to increase the efficiency of crop yield various study is done. Some computer science researchers solved few agricultural problems using computer science techniques. The main and most value able advantage of their work is that, their solutions replaces traditional manual methods which are very time consuming and inefficient over large area. This literature survey is grouped according to common method used for solving agricultural problems like detection, quantification and classification.

In detection, authors are only detects or recognize only one problem at a time for only specific agricultural crop. Main disadvantage of these detection solutions are these methods are not suitable for other problems detection or any other agricultural crop. These detecting solutions are only focus on detecting problem not to measure its severity type. This detection techniques are in the initial phase of agricultural image processing.

In quantification type, methods are implemented for quantifying the severity of that agricultural problem. These quantifying methods are gave more accurate measures of severity than any manual agricultural specialist measurement methods.

Classification methods are considered as extension to detection methods. The single problem oriented drawback of detection methods is removed in classification methods. Because of classification, researcher can maintain their logic to identify more than one disease problem by just changing the extracted features.

In the following table, computer researchers' work is elaborated.

TABLE I
SUMMARY OF RESEARCHERS' WORK

Sr. No.	Research work about agricultural computer vision system					
	Author	Solution Type	Main Technique	Crop Name	Extra Information	Reference
1	Abdullah NE, Rahim AA, Hashim H,Kamal	Detection	Neural network	Rubber tree	Leaf disease classification	[1]
2	Boese BL, Clinton PJ, Dennis D, Golden RC, Kim B	Quantification	Color analysis	Zostera Marina (Eelegrass)	Leaf injury analysis	[2]
3	Boissard P, Martin V, Moisan S	Quantification	Knowledge-based	Greenhouse crop (Roses)	Pest detection	[3]
4	Camargo A, Smith JS	Quantification	Thresholding	Banana	Visual symptoms	[4]
5	Jian Z, Wei Z	Classification	SVM	Cucumber	Leaf disease	[5]
6	Pugoy RADL, Mariano VY	Classification	Color analysis	Rice	Disease detection	[6]
7	Zang M	Classification	Feature-based rules	Citrus(Orange)	Canker detection	[7]
8	Zhou Z, Zang Y, Li Y,	Quantification	Fuzzy logic	Rice	Hopper infection detection	[8]

Volume 5 Issue V, May 2017
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From above table, we got information that researchers' solutions are very specific to single crop and for only single disease of that particular crop. Sometimes very complex methods are used to find solutions when simple alternative methods are available. To find solutions on agricultural image processing, there is requirement for generalised common method.

III.SYSTEM OVERVIEW

A. *Problem Statement*

To construct a system that efficiently recognizes nutrient insufficiency from captured leaf image.

B. *System Architecture*

Fig. 2 shows system architecture of nutrient insufficiency recognition system.

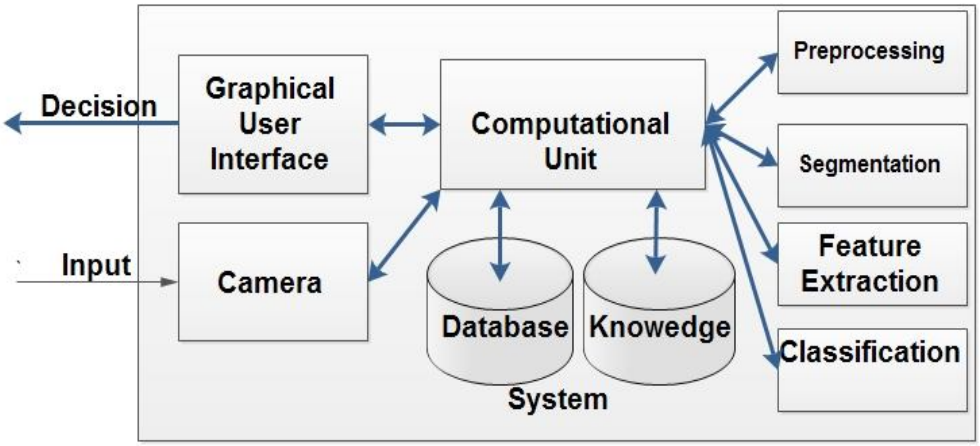

Fig. 2 Nutrient insufficiency recognition system architecture

Camera component is used to capture real time image of leaf of agricultural crop. The extracted visual information is stored into database. Knowledge database is used to store tree. The processing unit is used for doing all required processing.

C. *Working of the System with Algorithms*

Step 1: Capture image using camera.
User captures infected leaf using smart phone camera and store into internal memory.
Step 2: Get interested part i.e. leaf only.
Apply canny edge detection algorithm on captured image
Boundary function applied to maximum edge points to locate leaf on that edge.

D. *Canny algorithm steps*

1) Apply Gaussian filter
2) Apply sobel mask to find edge strength and directions
3) Find edge according to strength
4) Remove weak edges

Step 3: Color based segmentation
Color based segmentation is done using Euclidean distance formula.
Step 4: Features extraction
Visual features are mapped into predefined color centroid. Calculating count of pixels, color name assigned as primary color, secondary color, third color.
Step 5: Classification Step
C 4.5 decision tree algorithm
Create tree with single root node
If all tuples have same class

Volume 5 Issue V, May 2017
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Then class name give to node and terminate.
Else find best attribute to split by information gain formula
Attribute name give to node and for each outcome of attribute apply c 4.5 decision tree algorithm recursively.

IV. RESULT AND ANALYSIS

Outcomes of our system are shown in the following figures and analysis is shown by charts.

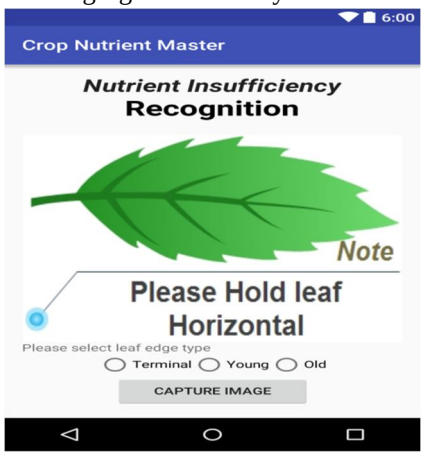

Fig. 3 Welcome Screen

Fig.4 Leaf Image captured using camera of smart phone

Fig. 5 Interested region finding using edge detection

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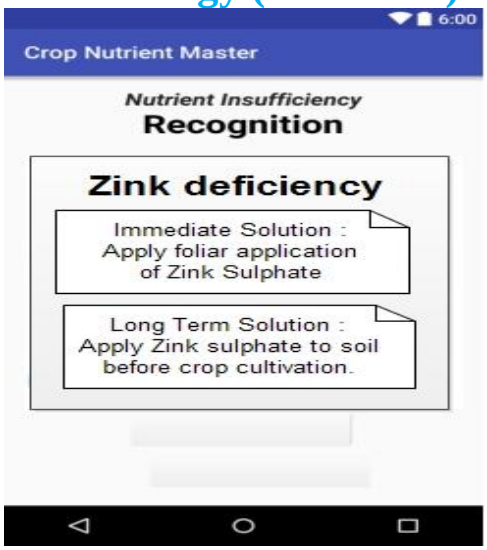


Fig. 6 Solution given to farmer

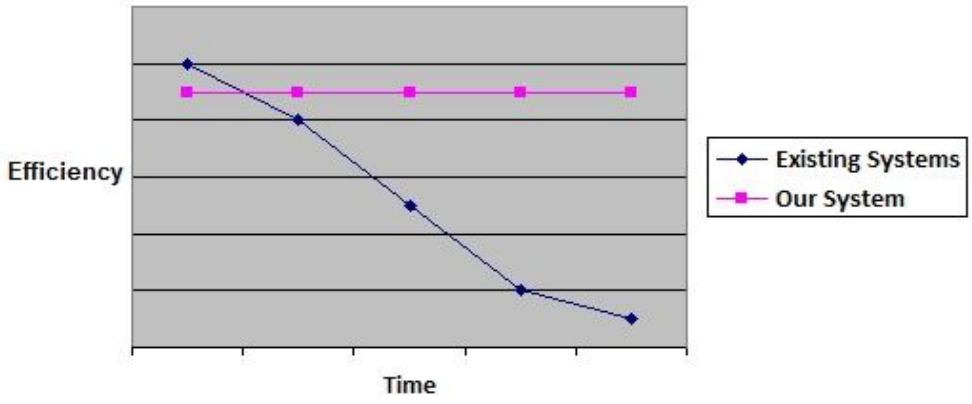


Fig. 7 Efficiency vs. Time

Above Figure 7 shows that efficiency of our system is steady as time enhanced but existing systems efficiency decreases because of human limitations.

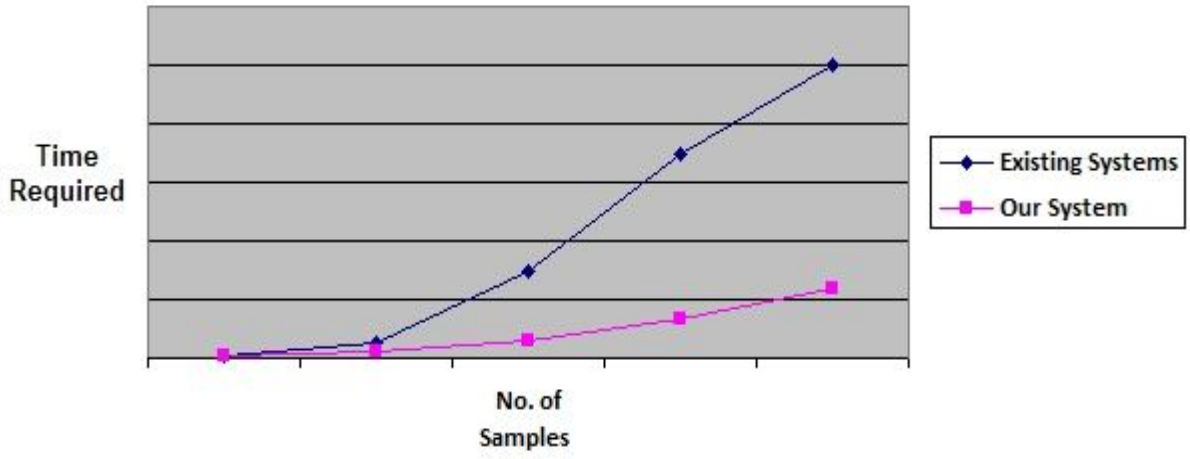


Fig. 8 Time required vs. No. of samples

From above Fig. 8, we found that our system required time is less than existing system as number of samples increases. Hence, our system is suitable for large number of samples.

V. CONCLUSIONS AND FUTURE SCOPE

For developing countries farmers, our system is very important and useful. Our computer vision nutrient insufficiency recognition system is very cheap, easy to use for farmers and effective to increase crop yield since at earlier stage, our system recognize nutrient insufficiency successfully and give remedial actions as a solution. As the smart phone available easily, our system easily can use by multiple country. Color features are very important because human being mostly depend on it to make decisions. Decision tree algorithm is suitable because it works like as human brain think and not complex than other classification algorithms. Our system eliminates major drawbacks of existing systems such as human errors, high time consumptions, less accuracy and high cost. Main and unique advantage of our system is our framework is applicable for various crop as well as many other agricultural computer vision problems. Because use of our system, crop yield and productivity increases as well as financial plus social situation also being better.

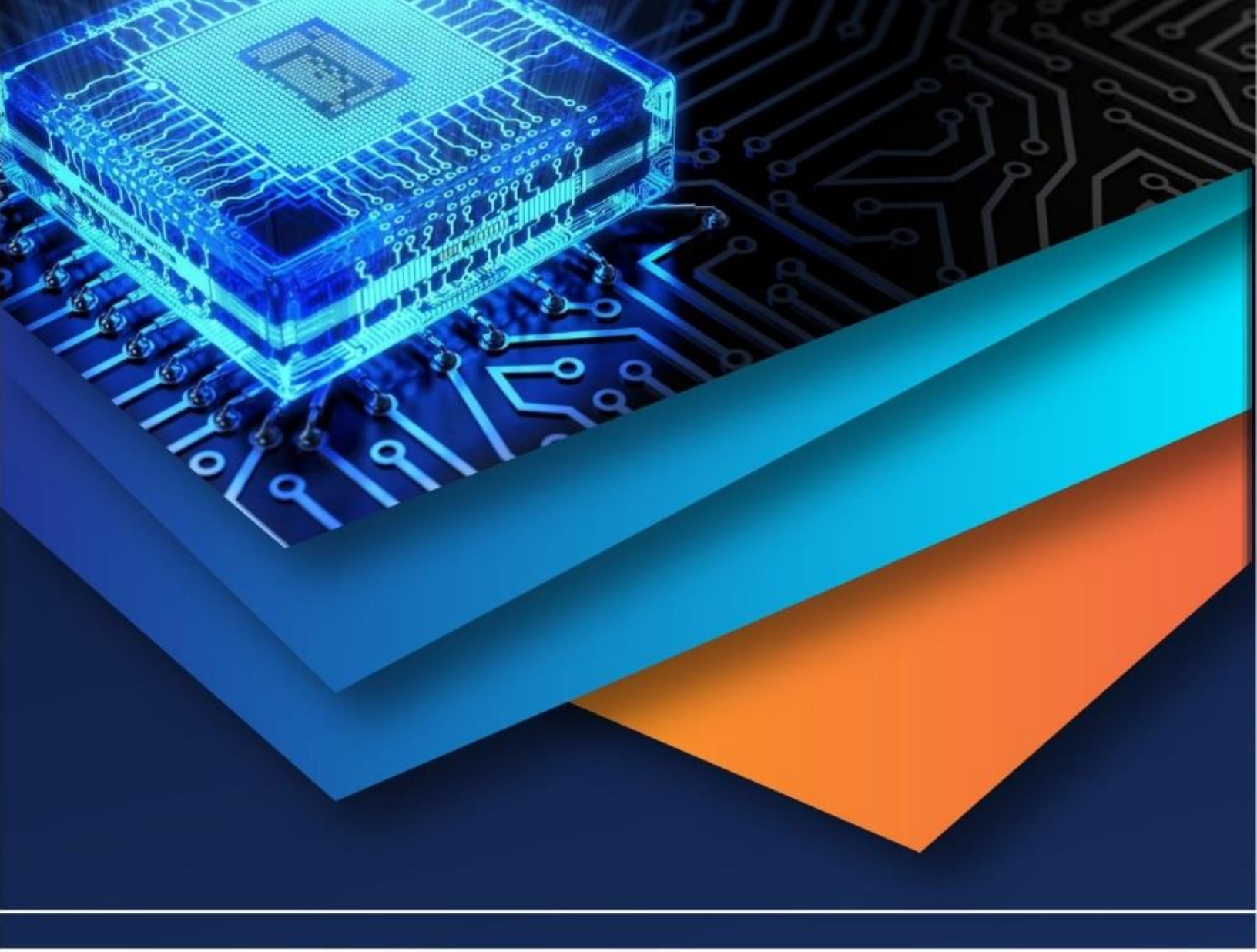
We only working on single image taken so future scope for our system will be working on video mode i.e. continuous time image this will increase helpful for tracking changes of leaf. As smart phone came with many facilities like global positioning system, internet, and researchers can use this extra features for increasing stability as well as ease of use.

VI. ACKNOWLEDGMENT

I would like to convey my genuine gratitude to my guide Prof. Deepak Gupta, Siddhant college of Engineering for his enthusiasm and practical suggestions which really assist me in developing the superiority and efficiency of this paper. I catch this occasion to convey my thanks to my teacher, family and friends for their support and support and priceless ideas.

REFERENCES

[1] Abdullah NE, Rahim AA, Hashim H, Kamal MM, “Classification of rubber tree leaf diseases using multilayer perceptron neural network”. In: 2007 5th student conference on research and development. IEEE, Selangor, pp 1–6 , 2007
[2] Boese BL, Clinton PJ, Dennis D, Golden RC, Kim B , “Digital image analysis of Zostera marina leaf injury”. Aquat Bot 88: 87–90, 2008
[3] Boissard P, Martin V, Moisan S, “A cognitive vision approach to early pest detection in greenhouse crops”, Comput Electron Agric 62(2): 81–93, 2008
[4] Camargo A, Smith JS, “An image-processing based algorithm to automatically identify plant disease visual symptoms”. Biosyst Eng 102: 9–21, 2009.
[5] Jian Z, Wei Z, “Support vector machine for recognition of cucumber leaf diseases”. In: 2010 2nd international conference on advanced computer control. IEEE, Shenyang, pp 264–266, 2010
[6] Pugoy RADL, Mariano VY, “Automated rice leaf disease detection using color image analysis”. In: 3rd international conference on digital image processing, volume 8009. SPIE, Chengdu, pp F1–F7, 2011
[7] Zhang M, “Citrus canker detection based on leaf images analysis”. In: The 2nd international conference on information science and engineering. IEEE, Hangzhou, pp 3584–3587, 2010
[8] Zhou Z, Zang Y, Li Y, Zhang Y, Wang P, Luo X, ” Rice plant-hopper infestation detection and classification algorithms based on fractal dimension values and fuzzy C-means”. Math Comput Model 58: 701–709, 2011.



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