Study of Detached (Fresh) Leaf and Dried Leaf with Image Processing

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***Abstract*—** Agriculture is the keystone of human being provisions on this world. Now with rising inhabitants we need the efficiency of the agriculture to be augmented a lot to meet the demands. In ancient days they used natural methods to boost the yield, such as using the animal dung as manure in the fields. That resulted increase in the productivity sufficient to meet the requirements of the population. Although later people started thinking of earning more profits by getting more result. So, there came a revolution called "Green Revolution". So, in this paper we have carried out some methods to measure the plant growth by the means of having area of a leaf. The study gives aspect of comparing the detached leaf with the dried leaf and it will be helpful to researcher to evaluate the dryness and also it will be helpful for the analysis at the time of biodegradation of the leaves and for the generation of organic manures. In this paper we implemented image processing using IJ (Image J 1.48V – Java 1.6.0_20(32- bit)) to measure various image processing related functions. And images of plants we took from D. K. Parmar's field.

Keywords: *Image Processing, Plant Images, Agriculture, Artificial Vision System, Threshold, pixel bitwise operations.*

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I. INTRODUCTION

India is an agricultural country; in which about 70% of the people spend their lives by agriculture. Farmers have extensive range of diversity to choose suitable Fruit and Vegetable crops. However, the growth of these crops for optimal production and quality produce is highly scientific. It can be enhanced by the assistance of technological support. The management of permanent fruit crops requires close monitoring especially for the managing of diseases that can affect fabrication considerably and consequently the post-harvest life [5]. The image processing can be applied in agricultural applications for following purposes (the corresponding applications only listed):

1. To detect diseased leaf, stem, fruit and roots.
2. To determine size & shape of fruits and plant.
3. To estimate chlorophyll content of a plant.
4. Measurement of plant leaf area.
5. Weed detection
6. Etc.

In countryside areas it is difficult to access these types of data and in India over 90% farmers are small and marginal farmers so the cost of these tools is not affordable to those farmers for farm management. Here we have carried out our job with only a digital camera costs not more than Rs. 12,000 [8, 9].

Image Processing:

An image can be defined as a function, F(X,Y), Where X and Y are spatial coordinates, and the amplitude of F at any pair of coordinates (X, Y) is called the intensity or gray level of the image at that point [11]. The field Digital Image Processing refers to processing digital image by means of digital computer. The digital image composed of a finite number of elements, each of which has a particular location and value, these elements are called Pixels.

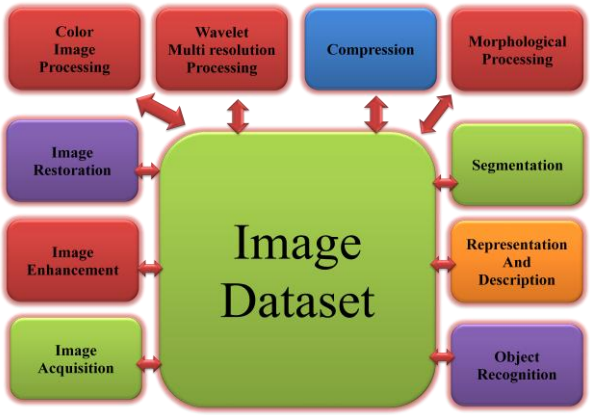

Fig1. Block Diagram of Image Processing

Farmers in general know that their fields have different yield across the land space. These variations can be counted by management practices, soil properties and environment characteristics. The elements that have an effect on the production are input parameters similar to quality of seed, water irrigation, fertilizer, environmental and weather parameters includes weeds, insects and diseases [7]. Finally by testing the development of crop it sends to market. In market there is incredible distinction in rate, depends on the value and amount of crops. To offer the good sympathetic of application of image processing in agriculture, the article presents the recent development of agricultural, specifically; the discussion is focused on wide literature review of significance of leaf area, leaf disease severity, leaf chlorophyll measurement of the crops [2, 3].

Leaf area measurement: Leaf area represents the amount of leaf material in ecosystems and controls the links between biosphere and atmosphere through various processes like photosynthesis, respiration, transpiration and rain interception. It also helpful parameter in evaluating, damage caused by leaf diseases and pastes, micronutrients deficiencies, water and environmental stress, need of fertilization, for effective

management and treatment. Precision agriculture production adapting rapid and accurate methods to measure plant leaf area. Present leaf area measuring methods are grid counting and paper weighing method, which are simple principals and high accuracy, but time consuming. The above constrain overcome by here with Leaf Area measurement. It is Java based software application (ImageJ) that works on Image Processing. It provides us the Leaf Area and Leaf Area Index (LAI) of plants [4]. It's highly user friendly and cost effective, try to provide higher accuracy than the available Leaf Area Measuring Instruments in market (e.g. Li 3100). The developed software proved to be an accurate method for measurements of area and perimeter of leaves and other planar objects, such as maps; extends the application of personal computers to such measurements; and was less expensive as it does not require additional hardware, only domestic camera is required.

Motivation

The available Leaf Area Meters are very costly (EgLi3100 : 1.45 lacks) with large degree of error associated to it. Also the Leaf Area Meters are heavy and not easily portable. Leaf area meter is high accuracy, but repetitions of readings are essential. Though the Leaf Area Meter is a less time consuming technique, but the precision is limited and high cost. Particularly in sugarcane leaf, size of midrib creates a problem in measuring by all these methods [6]. The disadvantage of the direct method is that it is destructive, time consuming and expensive, especially if the study area is very large. The disadvantage of the indirect method is that in some cases it can underestimate the value of LAI in very dense canopies, as it does not account for leaves that lie on each other, and essentially act as one leaf according to the theoretical LAI models.

II. Materials And Methods

Here in this method we have taken images of three plants namely Tulsi - Divine plant in Hindu System (*Ocimum tenuiflorum*), Brinjal - One most used vegetable (*Solanum melongena*), Pigeon Pea - a pulse (*Cajanus cajan*) and Asopalav (*Polyalthia longifolia*) – an ornamental tree found almost at every homes. The images were taken with resolution at 8 Mega pixels. Also the images were taken on the first day just after detachment of leaves and then after from 24 hour, 48 hour and at 72 hours. We have allowed some time interval for the leaves to dry and so we can measure the dryness index and our other objective can also be satisfied of the measuring the biodegradation of the plant. We have started with a very small sample size but in future we can improve the system and it can be performed for a large extent.

Now at the time of scanning and calculating we don't know the area of a leaf because it's an irregular shape. So the fundament is we want some referenced image so we can verify the accuracy of the software. So, for precise results we have taken two computer generated shapes, first is square and second is circle. Also we have taken one one rupee coin as we already know the area and we can reference out. We have also taken one cap of a jar because at the time of taking computer generated objects all are in 2-D but the jar cap and one rupee coin are in 3-D and hence we come to know the scenario as well as the leaves are also sometimes with thick parameters so the analysis will be helpful and supposed to reference for more accurate results. Also we have taken all the images at outdoor for management of proper illumination.

For taking all the images we have kept one scale with all these images because till now not any research suggests the direct measurement of area from photograph. Also we have taken care that the scale is of a paper scale because when we take a plastic or steel scale then it will produce some reflection and it will affect our image processing job. Also we have kept the leaves under a glass because after drying of the leaves they will have some dryness effect and their surface will got some bumps and without a proper surface we can't have accurate judgement [6].

Now first we capture photos of these referenced images for the said number of Mega Pixels. Then we will analysis how the software is giving results, since we know the results of the shapes (e.g. for Rectangle: 2500 mm2, for circle 1962.5 mm2) in advance. So these results can be used for the calculation of error ratio for leaves for irregular shapes. After preparing images we insert the images to ImageJ software and then take the image type as 8 bit, since we are only interested into the area of an image. Now for the 8 bit image we have taken thresholds of the image because it is required for the area calculation purpose [3]. Then after from Analyse menu we have set the scale and from Analyze Particles we can find the area of the image. We can also find the area of some dots and some holes in the image, but manually we have to remove that are because it is not required for our intended purpose.

Also we have taken the color histogram of the image, so we can compare the detached leaf with the dried leaf and we conclude that the older leaves shoes less number of pixels in histogram. All the results have been presented to Table 1.

III. Results And Discussion

After the image processing we kept the results in table 1, here we have pasted parameter of measurement means at which time we have taken the images, other referenced objects and a jar image. The other column is type of leaf, histogram and area of the object. After seeing the results we found that the area of respected leaf is gradually decreasing. The very first image at the time of detachment is our principle image and we considered the area as 100%. We can see for Tulsi, the decrement of area is 100%, 87.51%, 84.14%, to 57.66%. Like this for Brinjal it was from 100%, 98.35%, 87.26% to 66.67%. For Toor it was from 100%, 95.09%, 88.81% to 67.12%. For Toor leaf with hole it was from 100%, 92.71%, 89.48% to 63.80%. Finally for Asopalav leaf it was from 100%, 91.34%, 88.44% to 66.021%. Also we have tested the accuracy by taking some objects like one rupee coin, and the accuracy is 100.8128%. For 50 mm circle, 50 mm square and a jar the accuracy was 101.27%, 100.70% and 97.83% respectively. Parallel we have taken histogram and we found the difference in the histogram that gradually the numbers of pixels are decreased and it shows that the leaves are drying in some extent. At the time of histogram the results were given in the form of count, Min, Max, Mean, Mode and Std. Dev. So in this multiple facets we can analyze our results and we found the difference between the images. Also for image of Tulsi at 48 hours and for one rupee coin the images were not so good, so first of all we have to smoothen and sharpen the images and

then we could started the image processing job so it provides some ideas to the researchers.

The results are very helpful for the research of biodegradation and they can find that what time will be taken by agriculture waste to degrade and they also find that what amount of bio degraders to be applied to a specific class of leaves. From ImageJ software at the time of measurement we can find the results in the form of Area, Mean SD and Max. So in this aspect also the research is possible. In table 1 the bold letters are for objects we have taken for reference purpose.

IV. Conclusions And Future Work

We have taken some resolutions but they are for experimental purpose only but although we got better results at 8 MP, so one can take the reference also. In the long stretching world of Agricultural Sciences, our paper is only a humble venture of Information Technology in Agriculture. A large part of agriculture research is based on manual work that is highly prone to error. The use of Image Processing would reduce the large errors that are obtained while measuring the leaf area of fresh as well as for dried leaves. There is no claim of this product being perfect, or anything near that. This is only a humble attempt made under trying circumstances. After getting the results we came to know that at which extent the drying of leaves occurred and what the ratio of dryness is so it will be helpful for further research for composting and bio degradation. We have listed the percentages of drying of leaves so the research of bio degradation can take the help and can apply the degrading material in an accurate manner.

We have tested the three plants only and it won't have much economical values as compared to other plants like wheat and paddy. So one can plan for wheat and paddy as their husk is mainly used for composting and it will be helpful to the society also. As it totally deals with using of organic fertiliser only, it will be environment friendly also. We have tested the system only at 8 Mega Pixels but the problem is the image has very huge size, so we can advance the research starting from 4 MP to 8 MP. Also we have not standardised any image acquisition setup, so we can have the same one and in proper lighting condition we perform the job for having better results.

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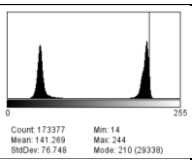
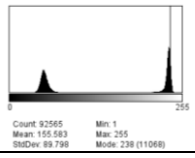
Parameter of Measurement(s)	Objects	Images	Histogram	8 MP
0 Hours	Tulsi			1023.098
24 Hours				895.341

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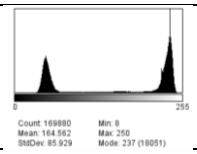
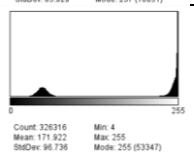
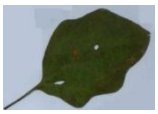
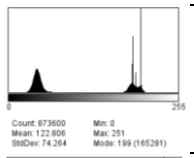
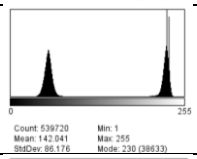
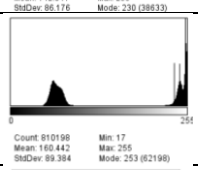
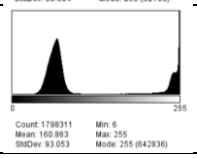
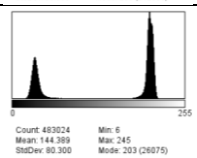
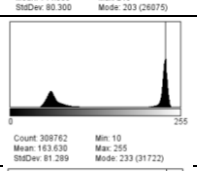
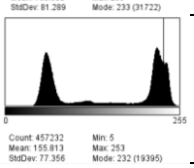
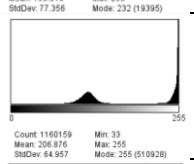
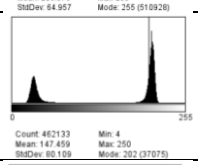
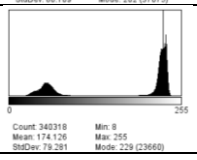
48 Hours				860.841
72 Hours				590.012
0 Hours	Brinjal			5935.858
24 Hours				5838.295
48 Hours				5179.898
72 Hours				3957.747
0 Hours	Toor			2762.360
24 Hours				2626.749
48 Hours				2453.373
72 Hours				1854.278
0 Hours	Toor leaf with hole			2421.403
24 Hours				2244.943

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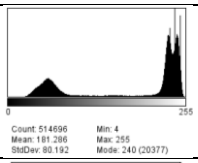
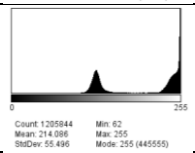
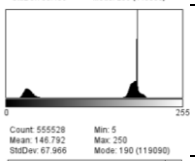
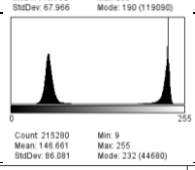
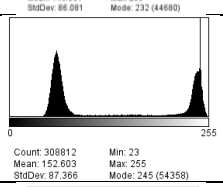
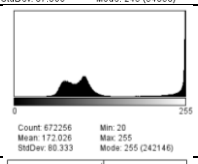
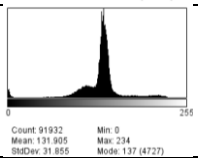
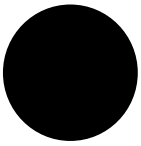
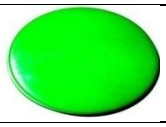
48 Hours				2166.836
72 Hours				1545.085
0 Hours	Leaf			2281.447
24 Hours				2084.063
48 Hours				2017.932
72 Hours				1506.247
One Rupee Coin				**494.613**
5 Cm. Diameter Circle			**Original Area = 1962.5**	**1987.562**
5 Cm. Diameter Square			**Original Area = 2500**	**2517.637**
Jar Cap			**Original Area = 3846.5**	**3763.276**

Table 1. Image Processing and Results