MEASUREMENT OF LENGTH AND WIDTH OF BETEL LEAF BY IMAGE PROCESSING TECHNIQUES USING MATLAB

K. Pramod, V.R. Nagarajan*

ABSTRACT

Leaf region performs an essential position in plant increase evaluation and photosynthesis. Traditionally leaf region is measured via way of means of regression equitation, grid matter technique, gravimetric technique and planimeter. Paan is the common name for the deep, heart-shaped betel vine leaves that are common in India. It is used in several traditional treatments. Consumers of today live fundamentally different lifestyles and have various requirements and interests. The betel vine's deep, heart-shaped leaves are referred known as paans in India. is utilized in some of conventional remedies. Customers' lives and desires today have undergone significant improvements. Farmers who must produce to satisfy customer demand now face new challenging circumstances. The size and colour of the leaf are crucial components for betel manufacturers to identify their product in the marketplace. This research presents a Betel leaf region size method that is entirely dependent on image processing techniques. Comparisons are made between the results and those of the graphical region size technique. Recognized region item is used as a reference to compare photo processing technique and graphics techniques. This technique is accurate with the least amount of relative error, according to experimental data thus far, for measuring the sugarcane leaf region. Digital photography, betel leaf, leaf area, and image processing are some of the key phrases.

Key Words: Digital photography, image processing techniques, Grid counting

I. INTRODUCTION

The only main sector of the Indian economy is agriculture. 65% of the Indian population is directly dependent on agriculture, which typically contributes about 22% of the GDP. Agriculture manufacturing must expand since it has a big impact on the Indian economy. Plant growth, which is limited by factors including light, temperature, water, and nutrient-rich minerals, is necessary for the generation of harvests. The growth of a plant is influenced by its height, stem width, leaf surface area, and leaf and stem range[1].The dark-green, heart-shaped leaves of the betel vine, also called paan, are frequently consumed by between 15 and 20 million people in India. There are more than 100 different types of betel vines, about 40 of which are found in India and another 30 in West Bengal. It is employed in some conventional treatments for infections and digestive issues as well as as a fashionable tonic. It's typically combined with betel nuts and chewed as a stimulant. According to some data, betel leaves may have immune-boosting qualities[2].

The region where betel is grown is around 55000 hectars, and the annual production value is estimated to be Rs 9000 million. In many different countries around the world, these leaves are also in high demand. This industrial leafy crop has the greatest potential to provide significant amounts of foreign currency for the nation given that leaves worth roughly Rs 30-$40 million are shipped to other countries. Earnings may soon outpace if agronomic strategies are extensively researched [3].The lives and desires of modern consumers have undergone exquisite changes. These changes present farmers with additional challenges because their products must now satisfy customer demand. Because betel leaf is a completely perishable product, it constantly faces the risk of spoilage due to dehydration, fungal

[1]Department of Computer Science
[2]Department of Computer Applications
Karpagam Academy of Higher Education, Coimbatore, Tamil Nadu, India
*Corresponding Author

infection, and dechlorophyllation, among other factors. Since growth, photosynthetic activity, and transpiration are all physiological processes, leaf region tracking is an essential tool for understanding these processes[2]. Additionally, it is a helpful criterion for assessing the severity of damage brought on by pests and diseases that affect the leaves, nutritional deficiencies, water stress, environmental stress, and a lack of fertilisation, as well as for effective prevention and treatment. Measuring all of a person's or woman's leaf regions is a simple technique to improve leaf region willpower. Another is to go in a different direction.

The production of precision agriculture uses quick and precise methods to measure plant leaf proximity. Grid counting and paper weighing methods are currently used to measure leaf area. These methods have simple principles and high accuracy, but they take time. Although the leaf proximity metre has excessive precision, it is still necessary to take many readings. The planimeter offers a method that takes a great deal less time but with immoderate cost and restricted precision.Many of those strategies are challenging to assess because the midrib, in sugarcane leaves in particular, is long-lasting[4]. When measuring the leaf area of coffee plants using the resource of using the usage of digital photo analysis, one model was based mostly on the height and width of the canopies, while the other was based exclusively on the position of a digital photo of a tree.. Frequency histograms were used to correct the images in this case, and the Otsu technique was used to achieve segmentation thresholding[5].

They discovered a connection between 0.82 and 0.91 by comparing the outcomes to the actual location of the leaves using a virtual scanner. They aggregated the coordinates of quadrangle corner elements in distorted images for specified non-poor leaf vicinity measurements using thresholding for image segmentation and the Hough Transformation.Using a contour extraction technique, which involved scanning pixels from one issue to the other in four commands to extract the contour and calculate the distance to the leaf using pixel range statistics; it was possible to mitigate the effects of holes present inside the leaf.Absolute mistakes were discovered. 2.88. In calculating the leaf vicinity of a cucumber using a photo processing approach, they used a reference item and a photo pixel range statistic[6]. They discovered Coefficient of variation of 3.99. They discovered 99% accuracy in the new leaf area processed in the Mat lab using computer-aided software. With the help of digital photos and a Matlab tool to process the photos, the location of the leaves is identified using this method. The results had been contrasted with those from the grid counting approach[7].

II. MATERIALS AND PROCEDURES

1. Materials

One rupee coin as a reference object, White Paper Sheet for Background, Mat Lab 7.4 Versions, Photographs of the arranged leaves the quantity.

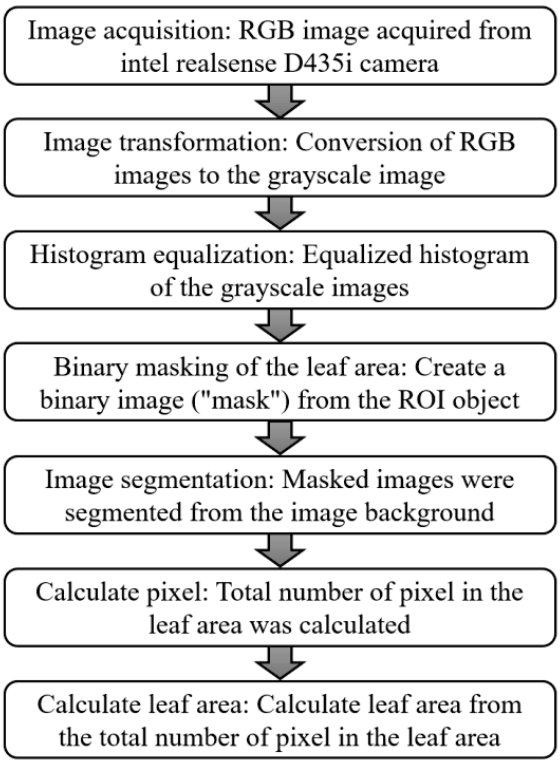

Fig1: An image-processing flow chart for measuring the area of leaves Methods

Image Processing Method:-

Graphical Method: A leaf with a measurement-required area has been laid on graph paper with a one-mm-long grid. Leaf is meticulously and appropriately drawn with a pencil on the graph paper. The typical number of grids covered by the resource of using the define edge of the leaf has been computed; interest has been treated as one if the aspect define occupied more than one-half of the grids, otherwise zero. The amount of grid dependence matches the real leaf region[8].

III. ALGORITHM

1.First, look at the picture.
2. Change an RGB image to a grayscale one.
3. Convert a picture from grayscale to binary

A) Purchasing photographs

As a recognised location object, a leaf with a diameter of 2.5 cm has been placed on the white ancient beyond where the measurement would take place. Leaf has been positioned in a flat and parallel position to the recognised object[9].Now holding the virtual digi cam parallel to the leaf's surface. As seen in fig. 1.1, the picture distance has been modified to include an excellent old wall, leaf, and recognisable object. It hasn't been placed too near or too far away.

Figure1.1: Using a 1 rupee coin as the reference object, a betel leaf

Figure2: Transforming a colour image into a grey image

Figure 3: Black-and-white image from Amount of pixels and actual size

Leaf pixels equal 3720
Leaf area is 122.30 cm2.
Figure 4 shows the number of pixels and the real size.

B) Identifying the region

Images captured in the manner shown in fig. 1 are processed in two colours using Mat lab code. Using Matlab's function region Size, the area in pixels of a selected area of a photograph was calculated[10]. The original image was converted into a binary image before employing the function region props, as seen in figures 2 and 3.

Coaching is used to determine the region's features, as shown in Fig. 4, in order to calculate the contained space. The location is the actual number of pixels inside the chosen area[11]. The final image's pixel count depends on how close the subject was to the camera when the photo was taken. Higher pixel counts occur when the area is smaller. An item is considered a reference if it requires translation of the location of the pixel substance. One rupee currency is used as a reference in this study, and its place is

Size of the coin == $n\left(\frac{d}{2}\right)2$, where "d" is diameter
N (2.5cN/2)2

$= 4.9063\ cm^2$

The pixel matter of the coin from the image is148 Therefore,1 pixel value is equal to 4.9045/137, or 0.03287 cm2, of coin area.

The area around Leaf has a pixel count of 3687.

Area of Leaf is then calculated as Pixel Matter X 1 Pixel Value
= 3783*0.03314
= 122.4496 cm2.

C) Equation 1 is used to calculate relative error, as shown in the example that follows.

$$Er = \frac{MC}{M}$$

Relative error is denoted by Er, degree value by Mc, and degree value itself by M. The leaf region is the fashionable region and degree real value of the grid counting.

Image Acquisition: A CCD colour camera is used to take pictures of various plant leaves. Leaves are gathered from agricultural fields. Leaf is placed on a white paper sheet with a black square measuring 2 cm by 2 cm for image acquisition.
Image Color Change

To eliminate the noise caused by the background, the camera light, and the veins CIELAB colour space is created by colour transforming an RGB image. Brightness and colour information are independent of one another in the CIELAB system, which is device agnostic. Brightness information is given by the "L" component in the CIELAB colour model. "A" and "B" describe information about colour. The LAB colour model conversion formulas are L =
Leaf Region Segmentation

The right leaf and acknowledged item must be detected in order for the leaf location size approach to be accurate. This study uses the threshold method to segment an image. Threshold is applied to the CIELAB shadeation space's "L" object. OTSU's approach is used to compute threshold. A segmented image is a binary image in which the history is segmented as a separate shade of grey from the leaf and acknowledged item. The tonality of this divided image is inverted. Cuts and patches on leaves are sometimes caused by diseases and insects. Those spots have the same shad eation in the segmented binary image history. Without closing those gaps, leaf location cannot be measured as it ought to be. By using nearby filler, these holes have been overfilled.

IV. RESULTS AND DISCUSSIONS

Leaves from unique plots and unique varieties of betel were selected to assess the effectiveness of the most recent sizing technique. The area of the leaf determined using a rectangular grid method is taken into account as the desired region. Table 1 shows the scale results using the preferred technique and the suggested technique with relative errors. Relative errors can be used to assess values and describe how accurate diploma values are. The relative placement errors of the leaves are calculated using an equation. It implies that even when accuracy is improved, the overall error rate is decreased. Relative errors will rise if a leaf has wounds from insect bites, shaded areas from illnesses, or unusual stress.
Leaf Area Calculation

Calculated are the initial number of pixels in the leaf region and the known object region. A 2 cm by 2 cm square is a known object in this paper. Therefore, the square object's true area is. The following method is now used to determine leaf area: Al = Pl Ps As (4) Where A is the square object's 4 cm2 area. Ps is calculated by counting the pixels in the square object, and Pl is calculated by counting the pixels in the leaf region. The formula above is then used to compute the leaf area ().

Leaf No.	Real Area real value measured M	Measured value for Area by New Method (cm2) Mc	Mistake (Er)
1	43.23	43.65	0.007
2	43.47	43.94	0.011
3	53.14	54.48	0.007
4	135.17	124.46	0.095

TABLE 1. Measured cost and measured cost are compared.

The implemented algorithm often results in a relative error between the suggested system's area measurement and the actual values of 0.029, which is very small.

IV. CONCLUSION

The position of the leaves is an important aspect of the plant to examine the boom and anticipate the production. For measuring leaf location, the grids remember approach and the gravimetric technique are frequently utilized. However, those methods require a lot of time and effort because they

must be applied to a huge range of leaves. The measurement of leaf location is done using a set of rules based on image processing. The device requires a PC, a white sheet, a black rectangular object measuring 2 cm by 2 cm, and a virtual camera. JPEG files are used to collect images..To remove noise, images are converted to a CIELAB shad eation region. Through the use of OTSU's method, the threshold is computed on the "L" side of the CIELAB shad eation area. By using the place filling approach, voids in the leaf area of a segmented binary image are filled. The location of the leaf is finally determined using a pixel wide variety statistic. The results are measured and compared to grid remember technique results.

This artwork explains virtual picture processing techniques for computing the Betel leaf region. The applied set of rules was successful in computing the Betel leaf areas. The grid counting techniques level the leaf area more gradually yet with extremely high accuracy. The methods for processing images quickly and accurately also have high degrees of precision and accuracy. If only the images of the leaves are preserved, the image can be processed whenever it is convenient. This enables the concept foundation for building handheld leaf region metres to suit precision agricultural requirements..

Due to plant diseases and insect pests, which remove portions of leaves from the plant or change their colour from healthy leaves, the relative errors appear to vary. This causes pixel counts to be lower than the actual pixel counts of the selected region, which results in incorrect area calculations. This factor will be crucial to include accurately calculating the area and assessing the disease's severity for the application of pesticides and fertilizers.

In order to accurately anticipate yield loss and plant growth, it will be necessary to compute the disease severity % on plant leaves.

REFERENCES

[1] "Agriculture overview", available on: http://www.ficcib2b.com/sector-overview-pdf/Sector-agri.pdf, accessed on May 24, 2012.

[2] Montgomery EG," Correlation studies in corn. Nebraska", AgrExpStaAnnu Rep 24, pp.108–159, 1911.

[3] Linda Styer Caldas, Carlos Bravo, Homero Piccolo, Carmen Rachel S. M. Faria," Measurement of Leaf Area with a Hand-Scanner Linked to a Microcomputer", R. Bras.Fisiol. Veg. 4(1), pp. 17-20.

[4] Ross, J., Ross, V., " Phytometrical characteristics of the willow plantation at Toravere", joint Swedish–estonian seminar, 24–26 september 1995. swedishuniv. agric. sci. uppsala, report 57, pp. 133–145, 1995

[5] ChaohuiLü, HuiRen, Yibin Zhang, YinhuaShen," Leaf Area Measurement Based on Image Processing", IEEE International Conference on Measuring Technology and Mechatronics Automation, pp. 580-582, 2010

[6] "Agriculture overview", available on: http://www.ficcib2b.com/sector-overview-pdf/Sector-agri.pdf, accessed on may 24, 2012.

[7] Montgomery EG," Correlation studies in corn. Nebraska", AgrExpStaAnnu Rep 24, pp.108–159, 1911.

[8] Linda Styer Caldas, Carlos Bravo, Homero Piccolo, Carmen Rachel S. M. Faria," Measurement of Leaf Area with a Hand-Scanner Linked to a Microcomputer", R. Bras.Fisiol.Veg. 4(1), pp. 17-20.

[9] Ross, J., Ross, V., " Phytometrical characteristics of the willow plantation at Toravere", joint Swedish–estonian seminar, 24–26 september 1995. swedishuniv. agric. sci. uppsala, report 57, pp. 133–145, 1995

[10] ChaohuiLü, HuiRen, Yibin Zhang, YinhuaShen," Leaf Area Measurement Based on Image Processing", IEEE International Conference on Measuring Technology and Mechatronics Automation, pp. 580-582, 2010.

[11] Hassan Hajjdiab, AbdellatifObaid," A Vision-based Approach for Nondestructive Leaf Area estimation", 2nd Conference on Environmental Science and Information Application Technology, IEEE, pp.53-56, 2010.