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A Real Time based Image Segmentation Technique to Identify Rotten Pointed Gourds

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***Abstract*— Every object can be identified based on its physical feature, let it be shape, size or colour. Keeping this in mind, a method has been developed which helps in separating rotten pointed gourds from a bunch of healthy and rotten ones. First, a real time image of the pointed gourd is acquired with the help of a webcam. Here the rotten gourds are extracted by the process of color thresholding followed by certain morphological operations. Feature extraction helps in further object classification and recognition. It has been observed that this method works accurately under any lighting condition. The study has been inspired by the need to find a method which is cheap, effective and a quick way to identify the rotten pointed gourds.**

Index Terms—**Feature extraction; Colour Thresholding; Morphological operations.**

I. INTRODUCTION

Half of India's revenue comes from agriculture, which pose as the mainstay of Indian economy. Any kind of improvement in the entire procedure can be of a help to the various stakeholders. In this paper, a similar approach has been followed which allows the demarcation of wasted rotten vegetables from the fresh ones in a convenient way. The vegetable that has been taken into consideration for this particular research here is the pointed gourd. It is one of the important vegetables grown in India and Bangladesh. It has a rich nutritional value and possesses the medicinal property of lowering total cholesterol and blood sugar. However, when it rots, it affects the overall quality of the pointed gourds. Hence, the separation of such rotten ones from a bunch of fresh and rotten pointed gourds is crucial. Sorting or identification of rotten pointed gourd is one of the essential post harvesting processes to ensure the quality packing in the vegetable industry. The traditional method of visual inspection for the identification is laboured intensive and prone to human error, so automated machine vision systems are needed to speed up the inspection process. Therefore, developing a fast, accurate and cheap method for sorting pointed gourds will be significant. In this paper, a novel method has been developed which identifies rotten gourds from a group of healthy and rotten ones based on their colour features, which has been implemented on the real time images of pointed gourds obtained using a webcam. In [1], the paper presents three major steps: First, by applying a Sobel operator, binary images were gained through extracting the edges of the gray images. Second, through morphological dilating and eroding, the de-noised wormhole edge images were obtained. The connected component of the binary images of the wormhole edge was labelled, and the first three longest components were considered as feature values of the worm channel, which were then normalized. Third, the normalized data were input to a classification system for extracting the worm eaten ones. A colour model based on the variability of normal colours is described to detect the defected apples in which each pixel of an apple image is compounded with the model. If it matches to the pixels then it is considered as belonging to the healthy tissue otherwise, a defected one [2]. An algorithm has been described to detect the defects in fruit by feature extraction. It has been designed in a way as to calculate weight for different features like intensity, colour orientation and edge of input test image [3]. [4], [5] presents the concept of widely used Machine Vision which uses machines instead of human eyes in carrying out measurement and judgment. The research and application of machine vision in agriculture which began in the late 1970s, was mainly for non-destructive testing of the quality and classification of fruits and vegetables [6], [7]. Automated machine vision system for sorting apple has been developed [8] and distinction between true defect and the stem end has been shown. Many image processing techniques were employed to extract texture features from captured images in various applications [9], [10]. The morphological dilation [11] is used to grow or thicken the object in a binary image. The specific manner and extent of this thickening is controlled by the shape of structuring element.

II. COLOUR SEGMENTATION

As the name implies, colour image segmentation is the process of dividing an image into meaningful structures. It is an essential step in image analysis, object representation, visualization and many other image processing tasks. Colour segmentation is categorized into the following types: Threshold based segmentation, edge based segmentation, region based segmentation, clustering techniques and matching. In this paper, we have applied threshold based segmentation as one of our proposed techniques. A test real time image of Cadbury gems has been taken to extract the different colour features by using colour thresholding. Figure 1 shows the real time image of Cadbury gems.

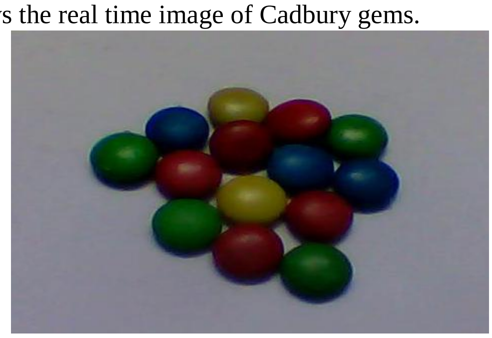

Fig.1: Test real time image of Cadbury gems

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Figure 2 and 3 shows only the yellow and green colour gems respectively. Similarly, the red colour gems are extracted as shown in figure 4.

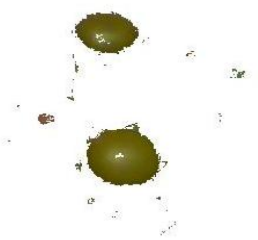

Fig.2: Extracted Yellow coloured gems

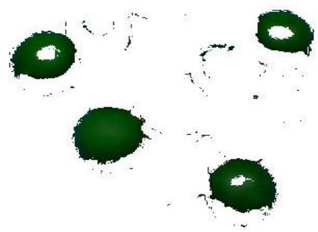

Fig.3: Extracted Green coloured gems

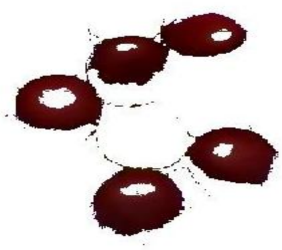

Fig.4: Extracted Red coloured gems

III. PROPOSED TECHNIQUES FOR IDENTIFICATION OF ROTTEN POINTED GOURDS

A. Image Acquisition

The real time image of pointed gourds consisting of fresh as well as rotten has been captured using a webcam (Vimicro USB2.0 UVC PC Camera). Here we have used two textures of pointed gourds i.e. green and yellow. The green colour pointed gourds are fresh and yellow colour is rotten.

B. Extraction of RGB planes

The captured RGB image is stored in a variable where the R, G and B components are extracted.

C. Colour Thresholding

For any lighting condition we have experimentally found the RGB values of rotten pointed gourds. The particular RGB values are experimentally obtained after vigorous practice. It is noted that the Red component of the pointed gourd varies from 130 to 180, the Green component varies from 130 to 150 and the Blue component varies from 90 to 150. So we have converted all the pixels into white (or 255) whose RGB values does not fall into the range of RGB value of rotten pointed gourd.

$$a(i,j) = \begin{cases} a(i,j);\ if\ 130 \le T_r \le 180\ \&\ 130 \le T_g \le 150\ \&\ 90 \le T_b \le 150 \\ 255;\ otherwise \end{cases} \quad (1)$$

Where, '*a*' contains the original values of RGB and *i, j* represents the rows and columns respectively. Here, T_r is the red component, T_g is the green component and T_b is the blue component
.

D. Converting the image into gray

The resultant image after colour thresholding is converted into gray using the following formula:

*Gray scale image = red component * 0.3 + green component * 0.59 + blue component * 0.11*

E. Application of Max Filter

In this case of rotten pointed gourd, the maximum filter is used for finding the brightest point in the image. Since the pepper values are low, even that is also reduced by this filter as a result of the max selection process in the sub image area S_{xy} (where S_{xy} represent the set of rectangular sub image window).

$$\hat{f}(x,y) = \max_{(x,y)\in S_{xy}} \{ g(s,t) \} \quad (2)$$

Where, $\hat{f}(x,y)$ is the filtered image and $g(s,t)$ is the original image.

F. Hole Filling Operation

A hole may be defined as a set of background pixels present in the foreground pixels. Here our objective is to fill all the holes with the foreground pixels. In our case we have filled the holes present in the binary image of rotten pointed gourds with one. We start from forming an array X_0 of zeros (the same size as the array containing *A*), except at the locations in X_0 corresponding to the give point in each hole, which is set to one.

$$X_k = (X_{k-1} \oplus B) \cap A^c \quad (3)$$

Where, *B* is the symmetric structuring element and $k = 1,2,3,\ldots$.

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G. Dilation

The operation of dilation is to grow foreground pixels and to thicken the background pixels in a binary image. This extension and thickening is controlled with the help of different structuring element. Here with the help of dilation we are able to expand the boundaries of the rotten pointed gourds.Let A and B be the sets in Z^2, then the dilation of A by B is denoted as $A \oplus B$. The dilation A by B is set of all displacements z, such that $\hat{B}$ and A overlap by at least one element and can be written as:

$$A \oplus B = \left\{ z \mid \left[\left(\hat{B} \right)_z \cap A \right] \subseteq A \right\} \qquad (4)$$

H. Labeling Operation based on Pixel Connectivity

Labeling operation enables us to calculate the number of objects using 8-connectivity. A connected component is basically a set of pixels forming a connected group in a binary image. In the labeling process, the connected components are identified and a unique label is assigned to each of them.

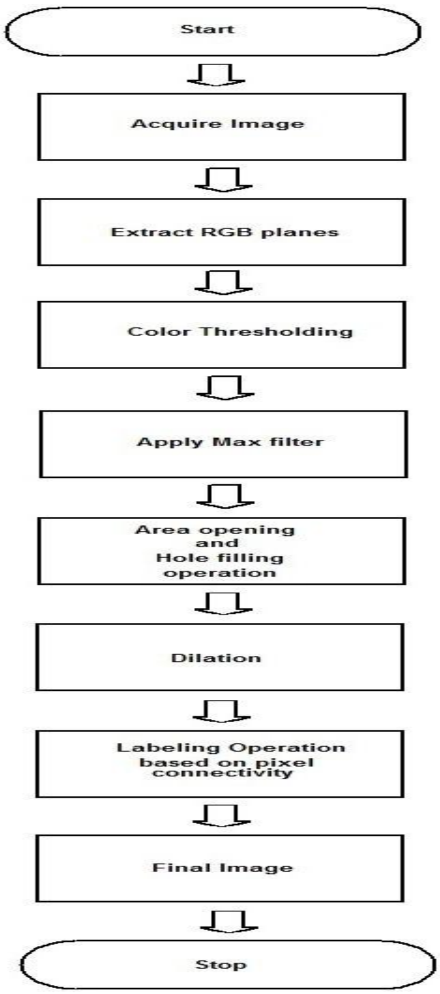

Fig.5: Flow Chart

IV. RESULTS

Fig.6: Real time image obtained by webcam

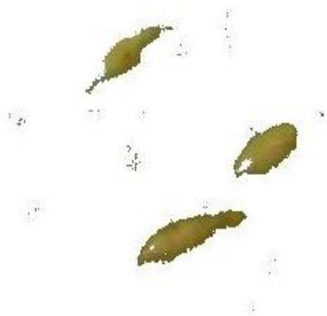

Fig.7: Colour thresholding

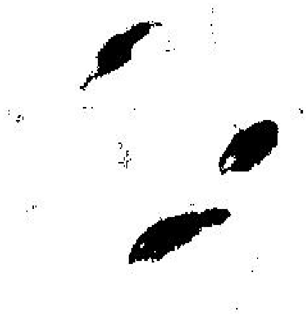

Fig.8: Conversion of Thresholded RGB image to binary image

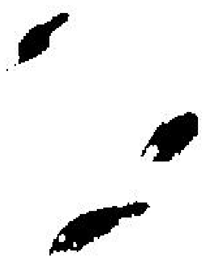

Fig.9: Application of Max Filter

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Fig.10: Reversing pixel value

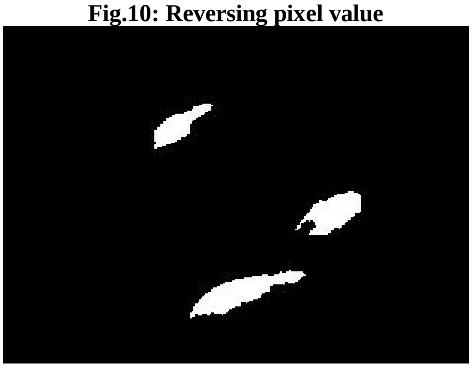

Fig.11: After hole filling

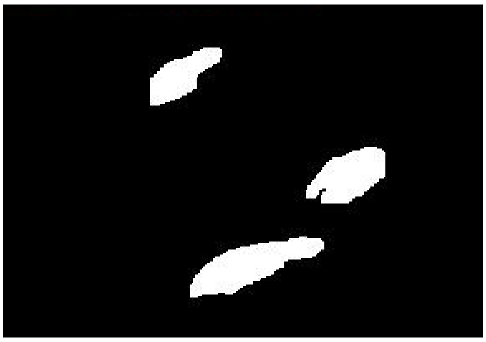

Fig.12: Dilation using disk of radius 3 as structuring element

Fig.13: Number of rotten pointed gourds identified

I. RESULTS WITH DIFFERENT LIGHTING CONDITIONS

Fig.14: Dark Lighting condition

Fig.15: Dull Lighting condition

Fig.16: Bright lighting condition

Fig.17: Normal Lighting condition (in the room)

Fig.18: Day lighting condition

V. CONCLUSION

The method was implemented on MATLAB platform version 7.0. The proposed method is a simple, effective , fast

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and efficient one and found to be robust to any lighting conditions.

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