Computer Vision Based Overlapped Flowers Detection

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Abstract— **Video surveillance has reached a major out-through by the application of advance image processing and frame modeling techniques. This thesis entails a proposed video surveillance system for flower yield detection. In this type of modeling a camera is considered static in front of a flower bed being surveyed for yield detection. A variety of flower species are considered under research including yellow, red and pink petals in each case respectively. The decision criterion for a yieldable candidacy remains flower size, number of petals etc. Color modeling is followed by morphological operations accomplished using dilation, erosion, opening and closing algorithms to remove any spurious noise with-in a camera frame.**

Keywords—image processing; segmentation; erosion; morphological processing;

I. INTRODUCTION

Floriculture is the branch of horticulture. Floriculture consist of traditional and modern flower crops in which modern flowers are grown in polyhouse or greenhouse while traditional flowers are grown in open fields[2]. One of the main applications of precision agriculture is yield estimation. Yield estimation means prediction of flowers in the field which are ready for harvesting[1,3]. Prior knowledge of yield will help farmer to preplan further task like transporting, packaging, preorder to consumers etc. For the yield estimation most of the categorization is done manually so far which is not only laborious but the cumbersome and time consuming as well. With the passage of time detecting and counting of flowers and there yield prediction is done by machine and computer vision[8,7].

In India other states of floriculture are Nasik, Pune, Hauser, Kodaikanal, Kalimpong, Ooty, Darjeeling, Bangalore, Palampur, Shimla, Srinagar, Delhi, Ludhiana and Calcutta as shown in figure 1.1 (Sudhagar, 2013)[4]. Yield estimation can be done under the precision agriculture. Precision agriculture (PA)[4-7] is defined as information and technology based farm management system that identify, examine and manage variability within farms for maximum benefit, sustainability and aegis of the land resource (Bongiovanni and Lowenberg-deboer, 2004)[10].

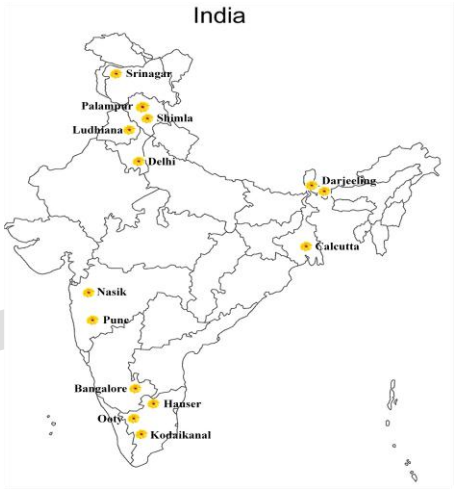

Fig. 1. Major floriculture region over India (Sudhagar, 2013).

II. LITERATURE SURVEY

In [8] analyzed the properties of HSV color model which was used for two applications such as segmentation and histogram analysis for object retrieval with the help of variation in hue, saturation and value of pixel features[9]. Authors extracted image pixel by either choosing the hue or the value as the dominant property based on the saturation of a pixel[1]. Results showed that segmentation was better using HSV color model then compared to RGB color model[3,5].

In [4] presented an algorithm based on edge detection and HSV color information. At first authors detected edge at the Region-of-Interest (ROI)[7] so they got the axis of symmetry and the edge of the vehicle. After detection of vehicles, shadow was discriminated with the help of HSV color information. The experiment showed that the algorithm can perfectly resolve the problem of mistaking dark moving object for shadow. The proposed algorithm promoted the accuracy of detecting shadow but its shortness for simple background. Complex background like zebra crossing, human etc caused error in shadow identification.

In [10] proposed an algorithm for flower image retrieval including many steps like filtering for noise removal, 2RGB mixed color model for image segmentation, support vector machine (SVM) based algorithm for flower image retrieval using shape and texture feature. Three experiment were carried out for segmentation, in first one pyramid segmentation based on HSV color model was applied which had good adaptability but poor segmentation for some

flowers. The second segmentation technique was based on saliency map, their results were poor for flowers which have same background. Third one was 2RGB color mixed model provided very good results for all kind of flowers and extracted flowers from the background precisely.

III. METHODOLOGY

The various steps include in experiment of detecting and counting the number of flowers was carried out step by step. Whole algorithm is subdivided into subsections. The flowchart of the process is shown in figure2.

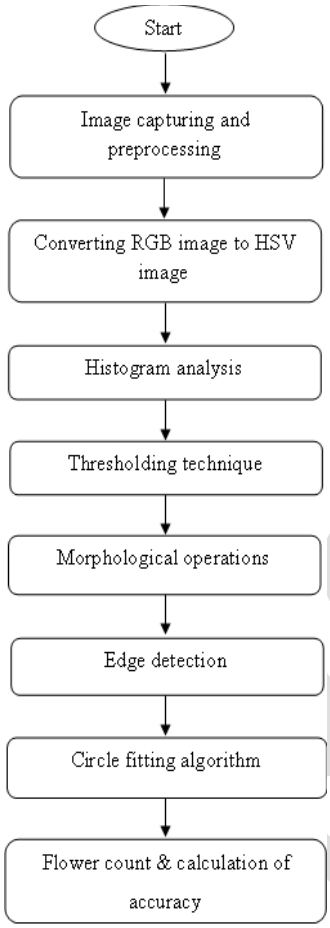

Fig. 2. Process flow chart for developed algorithm

Gaussian filter is used for smoothing and enhancement of image. Gaussian filter is an image processing filter whose impulse response is Gaussian function. It is designed to minimize rise and fall time with no overshoot. For developed algorithm we use combination of color and shape analysis using HSV color model because it provide better results in case for occlusion and overlapping and HSV is also close to the human perception. Table 1. depicts the HSV color bars.

Circular Hough Transform (CHT) was introduced for pattern classification as a powerful tool to identify the targeted object. Hough transform is a widespread and robust algorithm used for many image processing applications. The idea of the Hough transform is that the feature points of an image (real space) produces trajectories in a so called Hough space describes the feature of geometric shape (Cauchie et al., 2008).

Table 1 H SV color bars

	Nominal Range	White	Yellow	Cyan	Green	Magenta	Red	Blue	Black
H	0° to 360°	-	60°	180°	120°	300°	0°	240°	-
S	0 to 1	0	1	1	1	1	1	1	0
V	0 to 1	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0

IV. RESULTS

Numbers of flowers are processed using image analysis for counting purpose. The images undergo with several processing steps and finally we got the results. The basic flow diagram for developed algorithm is shown in figure 3.

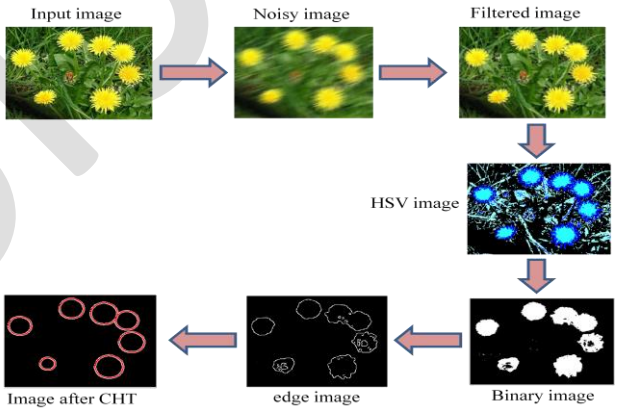

Fig. 3. Flow diagram for developed counting algorithm

Every image is captured in the farm so that captured image is affected by blur and noise. Open field images are affected more as compared to polyhouse images because of presence of wind and illumination. For removing of this attributes we use number of filters such as Average filter, Circular averaging filter, and Gaussian low pass filter.

For flower counting, radius of flower should be properly defined. Two radius values higher and lower are used as a threshold value in the algorithm which covers all the flower radius. Range of radii for the circular objects we want to detect, specified as a two-element vector, $[r_{min}\ r_{max}]$, of integers of any numeric type. This numeric value selection for maximum and minimum radius is very important in circle fitting algorithm. If it is not properly defined than it may be result in false detection of flowers.

Threshold value for radius is selected from hit and trial method which is shown in figure 4.

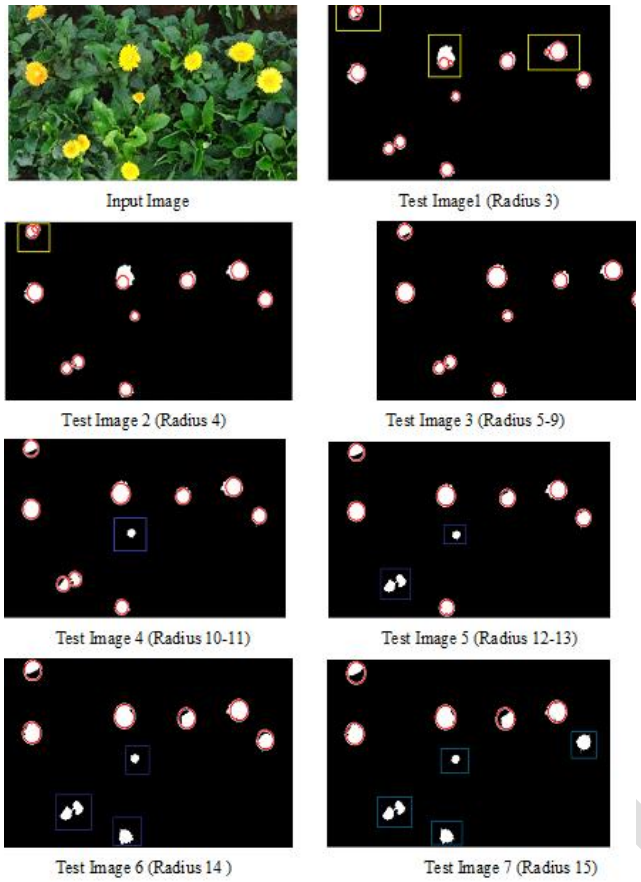

Fig. 4. Effects of selection of radius range

V. CONCLUSION

The word "yield estimation or prediction" means estimation of crop in the farm. Yield can be estimated after or before harvesting. In after harvesting floriculture product is estimated by counting of all the flowers or calculating the weight for all. This method has the disadvantage that it affects the preplanning of farmer for e.g. packaging material. If the yield is more than packaging material does not fulfill the farmer requirement. So the yield estimation before harvesting is used in practice. Numbers of machine and computer vision techniques are available for this task. In computer vision applications first step is capturing of image of whole field. And it is difficult to capture field in single image so images are captured in the parts of field and processed individually and after that their results are combined. For extraction of flower HSV color space is used. HSV color space transformation of RGB image provides a better segmentation and it is device dependent model. After color segmentation based image, circle fitting algorithms was applied and then counting can be done.

Table 2: Summary of accuracy for all types of flower

S No.	No. of images processed	Flower type	Accuracy
1	15	Yellow Gerbera	92.30%
2	20	Yellow Marigold	95.00%
3	10	Coltsfoot	90.64%
4	10	Dandelion	89.50%
5	10	Buttercup	89.57%
6	20	White Marigold	87.53%
7	10	Red Gerbera	92.90%
8	7	Water Lily	82.48%
9	2	Red Tulip	91.01%
Overall accuracy for developed algorithm = 90.10%			

Results obtain from simulation and various graphs showing that developed algorithm is more accurate and efficient. It detects and count number of flower closed to the manual count. For removal of noise we apply number of filters in which Gaussian filter provides best result. Gaussian filter does not useful for 100% removal of illumination problem but minimize to some extant. Radius range plays a vital role for efficiency of flower detection. Minimum threshold for range should be selected in such a way that it does not give false detection and also flowers are not missing for counting. Maximum threshold value of radius should be kept maximum. The radius range for developed algorithm is lie in between 10 (r_{min}) to 60 (r_{max}).

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