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Image Derivative and K-means Clustering based Dead Zone Identification from Flower Image

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***Abstract*:- Nature's most lovely gift, flower which is also the reproductive system of a plant which is why we need to pay more attention towards its protection before it gets demolitionist due to disease, as we not only loss a flower but also a plant produce. So, presenting our paper on flower disease detection using image processing techniques. We have analyzed the diseased flowers and separated the affected parts from the normal area by k-means clustering method. Basically, plant parts were gathered and tested over techniques like HSV, color slicing, enhancement, RGB, L*a*b color model to differentiate between the dead area and colored area. A derivative form of edge survey has been done to identify dead zone is used.**

Index terms: Hue Saturation Value (HSV), Color slicing, Enhancement, Red Green Blue (RGB), L*a*b color model, Segmentation, Gray threshold, K-means, Noise.

1. INTRODUCTION:

In our country more than 1,380 lakhs people are live in India till 2020. In Indian culture many people are use the flower from wearing, worship for god, consuming as a food etc.

In Indian Ayurveda we found people are majorly used flower as medicine also. Medicines are used for both human being and creatures. Around 70% of people are depended on agriculture according to Indian economy. Many peoples are identifying the plant with their flowers and leaf. Flowers are the sexual reproductive organ of the plant because they contain male and female reproductive organ. The characteristic of the flower is reproductive structure of angiosperms. Due to the climatic change, the most effective part of the environment is plant and some good insects, pests who are living in that plant like bee, silkworm. We identify or detect the diseases are simply view from the naked eyes and some chemicals or some medicines are applying for the plant for protect it.

In day-to-day life the technology is improve for all the departments like medical, horticulture, agriculture, and many other departments. Most people are use new techniques for developing their business or needed for their own work. Some parts of the plants are affected by the insects are eating the flower, leaf, roots and other parts of the plants and yield. The chewing insects consume the large amount of damage or disease parts. Now how to identify the diseases for putting some different technique for better achievement and reduce that problem. We use the image processing technique for elaborate the dead part or insects affected part for the flowers. Some another technique to enhance the notice the flower. Quantization, color model sand any other technique is use for better achievement to our goal. Its helps to study the affected area, which are affected by fungal, pathogen, bacteria.

Identification is the basic part of disease detection. Therefore, our paper is mainly focused on easy and early detection as well as providing remedy for that particular disease detection, which will be helpful mainly in the field of floriculture. As for the productivity of plant materials like seeds, cuttings, budding, grafting etc. are dependent on the optimize cultivation of flower and its produce. For better enhancement in traditional as well as nontraditional flower crop production and to establish awareness in grower for commercial motivation.

2. RELATED WORK:

Hadis Biabia et al. says agriculture's main goal is to consume the water. For the new technique the low-level water or wasted water [1]. For the automated machine vision system to fulfill the water obligation of ilium plant, new machine technique was innovated for better achievement. Initially the mean of RGB and HSV color model of leaves, stem together with the curvature and distance length wise along with the direction of stem were extracted. Further for characters examinations following technique were adopted.

(a) Duncan's multiple range tests
(b) Linguistic hedges feature selection algorithm
(c) Adaptive neuron-fuzzy classifier

According to the outcomes the most valid character was HS, curvature, stem angle, HL, BL, and LL. Hence the aftereffect suggested that the techniques and methodology have the capacity to establish the level of water presser and it can supply the exact quantity of water necessity.

Poonam Kumari et al. discuss about various photochemical present in different flower [2]. The photochemical includes phenol acids, arytenoids, and flavonoids including anthocyanin. These photochemical have different properties which include many medicinal values. This paper presents a brief detail about the photochemical present in edible flower and now we can utilize it.

S. Minaei et al. proposed this technique smart detection and spraying system help to identify rose diseases using both thermal and visible images [3]. It consists of a thermal camera and a visual camera mounted on a c-shaped carriage. The carriage is able to move around the rose shrub. The site-specific spraying consists of an electrically actuated pneumatic directional valve, a pneumatically actuated directional valve, a pressure regulator, a pressure regulator, a pressure tank, nozzle a compressor, a manual flow control valve. Then droplet volume median diameter, % of coverage and system performance in spraying their location were evaluated.

Prathyakshini et al. proposed for leaf disease identification using technique and methodology involve image processing and the whole thing is achieved using the segment by k-means clustering method [4]. It is mainly based on spotlighting the affected area and disease classification.

The steps mainly involved disease detection that are image acquisition, where image is captured and then preprocessed, and noise is removed. After that image is segmented and divide into its category by k-means algorithm. Subsequently diseases were classified extracting the features such as texture, color, morphology, edges etc.

The appearance of greenness shows that leaf is healthy and by clicking the green cluster the type of disease can be identified which is followed by measurement of affected sector and finally using SVMs method disease classified.

Tanakorn Tiay et al. proposed this method for identification and analysis of flowers. In this method first the real image is rescaling for rapid processing [5]. To get the image of flower only the graph cut algorithm and RGB to grayscale conversion is adopted. After receiving the edge features by Hus seven moment algorithms and color features K-nearest neighbor was used to organize flowers. This system can be upgraded to give accurate results by mixing other characters like number of petals and flower texture.

Prabira Kumar Sethy et al evolved algorithm, HSV color space transformation of RGB image provides a superior segmentation. After color segmentation-based image, circle fitting algorithms were put in and then counting was concluded [6]. In this they utilize circular Hough transform for circle fitting algorithm which was tougher and was able to sum up the occluded and fold over flower. The advance algorithm efficiently detects and counts the marigold flower with less error. The outlook of the algorithm will hasten to design an automatic counting system of marigold flower and will be efficient for giving information about flower manufacturing to farmers.

Ram Chanda Barik et al. analyzed different technique so that pesticide uses can be optimized. Which could help farmers in many was as they face many loose due to these pests and diseases [7]. They use the algorithm of K-means clustering method and segmented the pest region form the collected sanded image.

Rajat kumar sahoo et al. introduced clustering, color object established upon segmentation and color transform technique using important features identification [8]. It’s based on the analysis used over identification of diseased leaf to layout edges and dead zones.

Ryan Horton et al. surveying of crops and its analysis are the benchmarks for crop production [9]. So here to ascertain the peach, blossoms on trees an image processing algorithm is used. A simple image enhancement technique or normalization technique of their bands to increase the image and segmentation method is mainly involved to detect the blossoms.

Shamik sural et al. mainly focused on visual concept on changes in hue, image pixels saturation and intensity value. What they have done is analyzing the visual characteristics of the HSV color space and consequently [10]. Its application in computer vision techniques to the image retrieval problem specifically speaking then content based visual information retrieval. Then segmentation technique is used to disintegrate the image to useful segments to achieve a better foreground and background objectified image pixel.

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Table 1. Diseased of flower image collection and description

Flower Specimen and Botanical Name	Disease's flower	Description	Diseases
1.Dahlia 		It is a genus of bushy, tuberous, herbaceous perennial plants domestic to Mexico and Central America. It is the member of the composite family of dicotyledonous plants, its garden relatives thus include the sunflower, daisy, chrysanthemum, and Zinnia.	Aster yellows, Bacterial stem Rot, Gray Mold, Powdery Mildew, Storage Rot, Verticillium Wilt, Virus, Virus
2.Jasmine/jasmine 		It is a genus of shrubs and vines in the olive family (Oleaceae). It contains around 200 species domestic to tropical and warm temperate regions of Eurasia and Oceania.	Bud worm
3.Levender/Lavandula 		It includes annual or short-lived herbaceous perennial plants, and shrub-like perennials, sub shrubs or small shrubs.	Fungal disease,
4.marigold/Tagetes 		Agate's species vary in size from 0.1 to 2 ,2 m tall. Floral heads are typically (1-) to 4-6 cm diameter. It has fibrous roots.	Alter aria leaf spot, Botrytis blight
5.Orchids/  Oechidaceae		Orchids are bilateral symmetry of the flower (zygomorphic), resupinate flowers, a nearly always highly modified petal (labellum), fused stamens and carpals, and extremely small seeds.	Brown spots

6.Rose/ Rosa rubiginosa 		It perfumes are made from rose oil (also called attar of roses), which is a mixture of volatile essential oils obtained by steam distilling the crushed petals of roses. It hips are used for produce rose hip seed oil which is used for makeup products.	Black sport is caused by the fungus Diplocarpon Rosa. Another disease is Powdery Mildew which caused by the fungus, ver. and produced a grayish-white powdery substance on the surfaces of young leaves, shoots and some leaf drop may occur. Rose flowers and buds are often infected with the Gray-brown fuzzy growth of the Gray mold fungus Botrytis cinerea.
7.Sunflower/ Helianthus 		Annual and perennial flowering plants in the daisy family Asteraceae. Round flower heads in combination with the ligules look like the sun grow to a height of 300 cm.	Bacterial head rot, Rhizopus head rot, Sclerotinia head rot, Pho blight
8.Tulip/ Tulipa 		It has Cosmetic use like sensitive skin, used in creams, hand lotions and in essential oils. It also used in medical benefits like an excellent poultice for insect bites, bee stings, burns, and rashes on the skin.	It is fungal in nature. One common fungal disease is the Botrytis blight,

3. MATERIALS AND METHODS:

Advancement of research field is due to the different innovative projects put forward by various scientists all over the world. Our paper portrays a unique empirical analysis of disease affected zone as lifeless area spotting in a flower data set which was collected from various sources. After that the flower the data set is proceed in normalization process using image processing procedure like contrast stretching, denoising, and resizing. Distinct texture identification technique was applied such as edge detection (sobel, robots), gray scale thresholding, and color to gray transformation, saliency-based detection and color slicing. Then clustering using K-means based segmentation in L*a*b color space and based system in HSV color space. The overall flow diagram of this paper is show in the fig [1], the data set was taken from both online and natural sources.

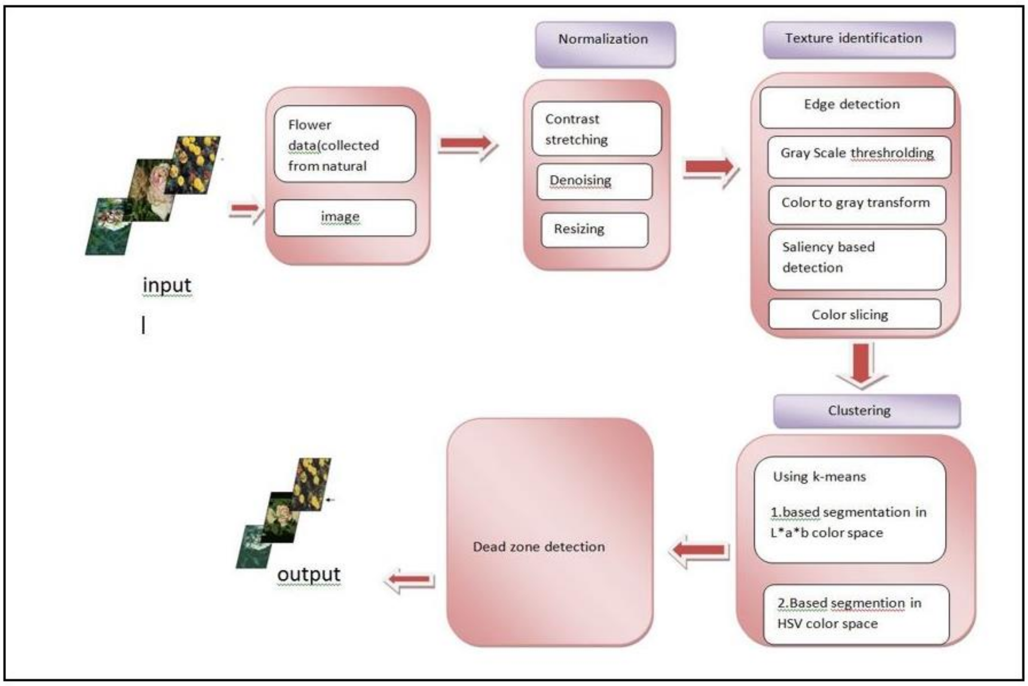

Fig.1. Overall flow of the proposed work

4. DISTANCE METRIC OVER K-MEANS CLUSTERING:

K-means clustering is a vector quantization method. It supported by signal processing method. Clustering is to solve the problem in many dimensions of science and engineering. K-means algorithm has played an important role by classification the data based on the interspaces between the Euclidean and Manhattan etc. represented in equation 1 and 2.

If a (a_1, a_2…a_n) and b (b_1, b_2…b_n) are two points in image space then the Euclidean distance in n-space can be mathematically represented as

$$D(a, b) = D(b, a) = \sqrt{\sum_{i=1}^{n}(b_i - a_i)^2} \qquad (1)$$

If a (a_1, a_2, a_3…a_n) and b (b_1, b_2…b_n) are two points in image space then the Manhattan distance in n-space can be mathematically represented as

$$V = \sum_{i=1}^{k} \sum_{aj \in si} (a_i - \mu_i)^2 \qquad (2)$$

The points are collection around mass center μi for all i=1, 2…...k, which is carry out by greatest objective or distance. Where there is k clusters si, i=1, 2…k and μi is the centered or mean point of all the points aj∈si [11, 12, 13].

(A)Saliency Calculation:

Radhakrishna Achanta et al. proposed a saliency-based feature calculation where each pixel has its own image. It depends upon the neighborhood image zone with various scales respectively that can evaluate the distance between the average characteristics vector of an image pixel. It secures a combined feature map which have a direction of each pixel image, alternatively combining classified saliency maps [14]. At a given scale, the contrast-based saliency value for a pixel at position (i; j) in the image is determined as the distance D between the average vectors of pixel features of the inner region R1 and that of the outer region R2 (Figure 2) as:

$$C_{i,j} = D\left[\left(\frac{1}{N1}\sum_{p=1}^{N1} Vp\right), \left(\frac{1}{N2}\sum_{q=1}^{N2} Vq\right)\right] \qquad (3)$$

Where N1 and N2 are the number of pixels in R1 and R2 respectively, and v is the vector of feature elements corresponding to a pixel. The distance D is a Euclidean distance if v is a vector of uncorrelated feature elements, and it is a Mahala Nobis distance (or any other suitable distance measure) if the elements of the vector are correlated which is mentioned in equation 1 and 2.

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(B)Edge Detection:

First order derivative in image processing technique to find the boundaries of object image. For a function f (p, q) the gradient off at coordinates (p, q) is defined as 2-D column vectors in equation 4 as

$$\Delta f = grad(f) = \begin{bmatrix} gp \\ gq \end{bmatrix} = \begin{bmatrix} \frac{\partial f}{\partial p} \\ \frac{\partial f}{\partial q} \end{bmatrix} \quad (4)$$

The rate of change off at location (p, q) is given by Equation 5.

$$\text{Mag}(\nabla f) = \sqrt{g}p^2 + \sqrt{g}q^2 \quad (5)$$

X_1	X_2	X_3
X_4	X_3	X_6
X_7	X_8	X_9

Convolution of filter with spatial synchronize based whole image is done to acquire the edge detected or segmented image show below the clean domino of 3*3 and 2*2 laded matrix.

X_1	X_2
X_3	X_4

(C)Roberts Method:

Robert mask having matrix conversion with the entire image using horizontally and vertically in both x and y coordinate respectively. Robert's mask is act below.

-1	0
0	1

0	-1
1	0

Horizontal derivative estimated as Equation 6 and vertical derivative estimated as Equation 7.

$$gx = (z_4 - z_1) \quad (6)$$

$$gy = (z_3 - z_2) \quad (7)$$

(D)Sobel Method:

Sobel mask having 3*3 matrix twisted around the whole image to growing the edge intensity below.

-1	-2	-1
0	0	0
1	2	1

-1	0	1
-2	0	2
-1	0	1

Horizontal derivative estimated as Equation 8 and vertical derivative estimated as Equation 9.

$$gx = (z_3 + 2z_6 + z_9) - (z_1 + 2z_4 + z_7) \quad (8)$$
$$gy = (z_7 + 2z_8 + z_9) - (z_1 + 2z_2 + z_3) \quad (9)$$

5. COLOR MODEL:

Color of an object is determined by the nature of light reflected from it when a beam of sunlight passes through a glass prism. The emerging beam of light is not white rather it consists of continuous spectrum of color ranging from violet at one end and red at another end. Visible light comprises 900nm-700nm.the chromatically is represented in term of three term such as radiance, luminance, and brightness. A no. of color models is originated from primary color model that is called as (a) RGB color model (b) CMY color model, (c) CMYK color model, (d) HSI color model, (e) HSV color model, (f) YUV color model, (g) YIQ color model, (h) L*a*b color model, (i) xyz color model. if comprises 3 color spectrums red, green and blue we find the seven-color red (0-60), yellow (60-120), green (120-180), cyan (180-240), blue (240-300), magenta (300-360).it is a subtractive color model for absorption of color is also called as secondary color of light. Conversion of RGB to HSI color model can be mathematically expressed in eq^n (10) and (11) as

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$$H=\begin{cases}\theta & if\ B \leq G \\ 360-\theta & if B > G\end{cases} \quad (10)$$

Where

$$\theta = \cos^{-1}\left\{\frac{\frac{1}{2}[(R-G)+(R-B)]}{[(R-G)^2+(R-B)(G-B)]^{\frac{1}{2}}}\right\} \quad (11)$$

The intensity level can be mathematically act for eq^n (12) as

$$S=1-\frac{3}{(R+G+B)}[\min(R,G,B)] \quad (12)$$

The value or Brightness component is mathematically represented in equation 13 as

$$V=\max (R, G, B) \quad (13)$$

For RGB component range is 0-255 it's mathematically represented as

$$\begin{bmatrix}R\\G\\B\end{bmatrix}=\begin{bmatrix}R/255\\G/255\\B/255\end{bmatrix} \quad (14)$$

YUV color model can be represented in mathematical form is.

$$U=\frac{(B-Y)}{2.03} \text{ or } 0.493(B-Y) \quad (15)$$

$$V=\frac{(R-Y)}{1.4} \text{ or } 0.877(R-Y) \quad (16)$$

Where Y is intensity value.

L*a*b is a most preferable color model. Where L is the lumina range to black to white in uniform state where a & b value are represented as +a for red and -a for green. +b for blue and –b for yellow. Mathematically L*a*b is being represented in equation 17 as

$$L^*=116y\left(\frac{Y}{Y_n}\right)-16\ ,\ a^*=500\left(f\left(\frac{X}{X_n}\right)-f\left(\frac{Y}{Y_n}\right)\right),\ b^*=200\left(f\left(\frac{Y}{Y_n}\right)-f\left(\frac{Z}{Z_n}\right)\right) \quad (17)$$

X_n, Y_n, Z_n are CIE tristimulus value of white.

6. COLOR SLICING:

It emphasizes a variety of colors to differentiate the object forms its background. The main theme is to

1. Show the color of interest.
2. Use the zone as conceal for more pressing.

Color slicing is use for better achievement to be dividing the color using RGB to advance level of dappling HSV color technique. It's separated the object of an image and the background image.

The color of interest (COI) can be specified by a cube or sphere. If the COI is a cube of width W which can be centered over a range of prototypical color components $(a_1, a_2, \ldots, a_n)$ which can be used to derive the transformation as shown in equation 18.

$$S_i=\begin{cases}0.5 & if\ \left[\left|r_j-a_j\right|>\frac{W}{2}\right]_{for\ any\ 1\leq j\leq n} \\ r_i & Otherwise\end{cases} \quad (18)$$

Where $S_i$the sliced color, r is the intensity or gray level range.

7. RESULT & ANALYSIS:

The data set are collected from the garden and some are from the internet. The image is passed through various stages in the process which detect the dead zone automatically. Here many segmentation techniques due to variation of texture and the flower color in dataset.

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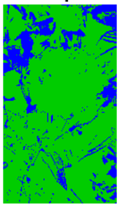
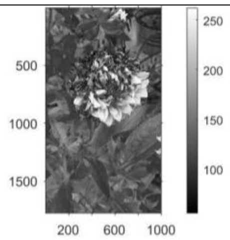
Table 1: Automatic Dead Zone Detection in 2-D Leaf Image Using Clustering and Segmentation Technique

<table>
<tr>
<td>
(a)Disease image of Dahlia</td>
<td>

(b)k-means segmentation</td>
<td>

(c) using k-means cluster partition in HSV.</td>
<td>

(d)distance measured in this scale</td>
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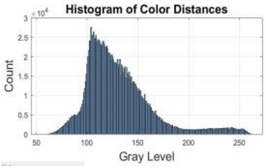
<tr>
<td>

(e)here it shows the histogram of color distance</td>
<td>

(f)it labeled the image using cluster index</td>
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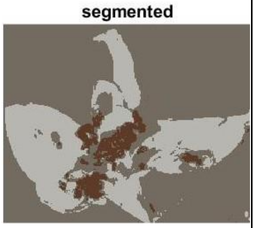
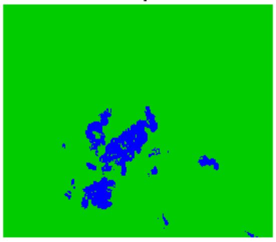
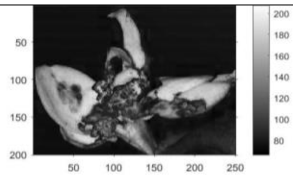
<tr>
<td>
(a)disease image of Jasmine</td>
<td>

(b)k-means segmentation</td>
<td>

(c)using k-means cluster partitioned HSV</td>
<td>
(d)distance measured in the scale</td>
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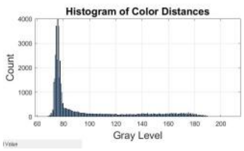
<td>

(e)here it shows the histogram of jasmine flower of color distance</td>
<td>

(f) it labeled the image using cluster index</td>
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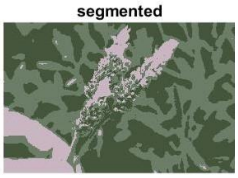
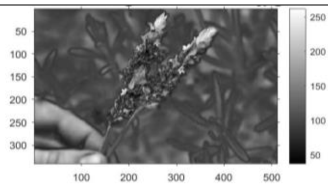
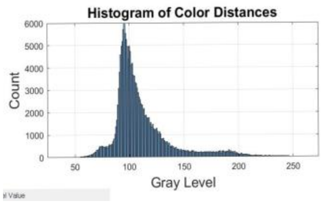
<tr>
<td>
(a)disease image of lavender</td>
<td>

(b)using k-means segmentation</td>
<td>
(c)distance measured in scale</td>
<td>

(d)here it shows the histogram of lavender of color distance</td>
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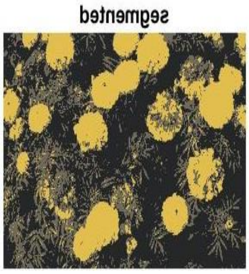
<td>
(a)disease image of Marigold</td>
<td>
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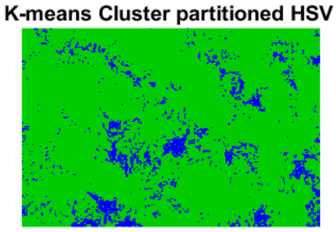
<td>
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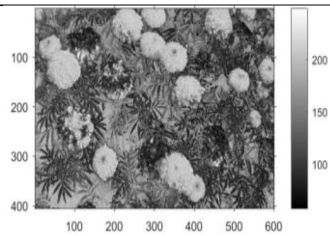
<td>
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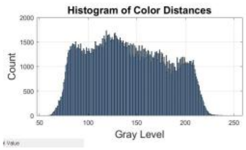
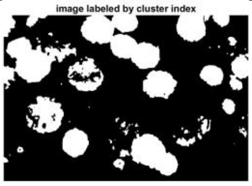
<td>
(e)here it shows the histogram of Marigold of color distance</td>
<td>
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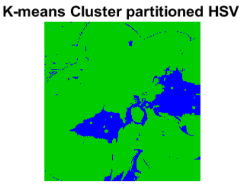
<td>
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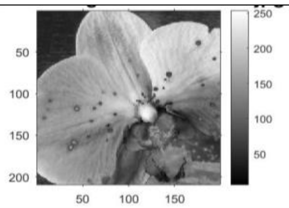
<td>
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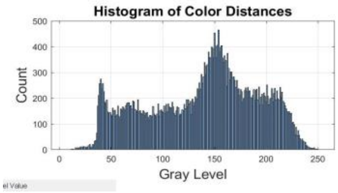
<td>
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<tr>
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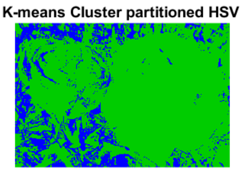
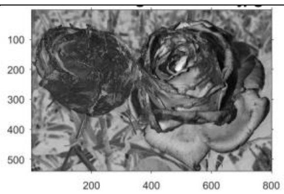
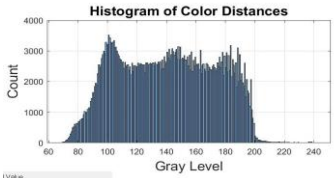
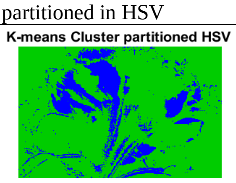
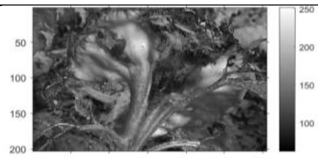
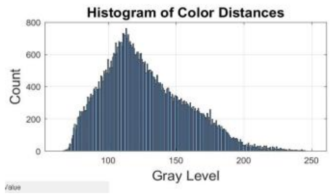
(a)disease image of Rose</td>
<td>
(b)using k-means cluster partitioned in HSV</td>
<td>
(c)distance measured in scale</td>
<td>
(d)here it shows the histogram of Rose image of color distance</td>
</tr>
<tr>
<td>
(a)disease image of Sunflower</td>
<td>
(b)using k-means cluster partitioned in HSV</td>
<td>
(c)distance measured in scale</td>
<td>
(d)here it shows the histogram of Sunflower image of color distance</td>
</tr>
</table>

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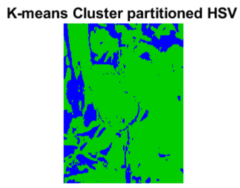
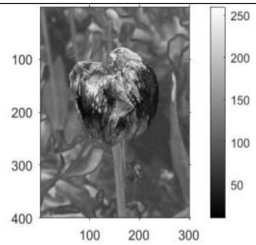
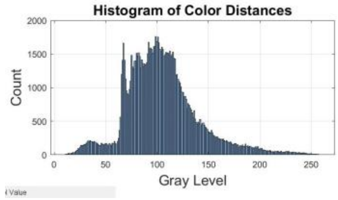
(a)disease image of Tulip



(b)using k-means cluster partitioned in HSV



(c)distance measured in scale



(d)here it shows the histogram of Tulip flower image of color distance

8. CONCLUSION:

A novel analysis has done in this paper impersonate the dead zone which are present in distinct flower in an effectual way. Segmentation, HSV based color segmentation using k-means clustering, Gray threshold using segmentation and salient features-based segmentation applied over flower samples to automatically detect the dead zone. In this paper the dead zone being justified. This work is constructive to detect the dead done in flower.

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