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Analysis of Storage Conditions for Senna Auriculata (Avaram Poo) Using Image Processing Techniques

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Abstract— ***Senna auriculata, also known as 'Avaaram Poo', is a flower rich in various medicinal properties that could be used to treat diabetes among other conditions. To evaluate the mor- phological characteristics of Avaaram Poo petals under different environmental situations, this study adopts image processing techniques using computer algorithms in order to analyze and modify digital images. In order to perform quantitative analysis, photos of the petals are taken with an open-source computer vision and machine learning software known as the OpenCV (cv2) library. These results exhibit some effect of the environmental conditions on petal's shape and size when Avaaram Poo plants are exposed to different environments and thus demonstrates the usefulness of imaging technologies for these studies on medicinal plant material. The work will add another feather to our understanding about how medicinal use of such plants can be extended beyond diabetes alone towards more therapeutic interventions while keeping sustainability in our minds for future projects on therapeutic applications of Senna auriculata.***

Index Terms— ***avaram poo, cv2, senna auriculata, image pro- cessing.***

I. INTRODUCTION

The Senna auriculata, commonly known as Avaram Poo, is a plant that has been growing there for many years in India and other tropical countries. The plant has been found to have several medicinal properties associated with it, specifically in the management of diabetes. However, even though its thera- peutic effects are recognized, the optimal storage condition for Avaaram Poo remains an essential aspect that is still needed to be studied more comprehensively. In this regard, therefore, the research intends to study the effect of varying storage environments on some morphological aspects of Avaaram Poo petals to establish which preservation method can enhance its medicinal efficacy.

In this study three different storage methods are used: hermetic container; water immersion; and open air exposure.

The purpose of this is to determine how environmental factors affect the characteristics of their morphology on Avaaram Poo petals. These digital images were taken using OpenCV (cv2), an image processing library and computer vision techniques employed for capturing and analyzing them. It allows quantitative evaluation of changes in petal shape over different storing conditions.

It is the purpose of this research to uncover the nuanced interaction between Avaaram Poo petals and environmental factors. These findings can therefore be used to improve the use of this plant in traditional medicine, as well as other applications by highlighting how it should be stored so as to preserve its healing properties. Moreover, it paves way for more studies that aim at unravelling more about therapeutic potentials in Avaaram Poo and improving understanding of its medicinal use.

This paper later describes how the research was conducted in details through methodology, presents results on Avaaram Poo petal morphology with respect to storage environment and discusses these outcomes broadly. This aims at contributing to the existing knowledge base on Avaaram Poo thereby laying foundation for further investigation into its health benefits and uses.

II. LITERATURE SURVEY

Avarampoo, a rich heritage of the plant deeply rooted in traditional medicine systems. This flower has been used for spermatorrhoea. In Kancheepuram district of Tamil Nadu, dried powder of flowers mixed with goat milk and taken orally to prevent white discharge. Also Andhra Pradesh tribal people use them as food items. The patients are given a mixture of whole plant of Enicostema axillare and fruits of Cuminum cyminum plus grass for three days to avert heat disorders

when the flowers are crushed with other parts, and fed to livestock along with cattle. A substitute for tea is prepared from dried flowers and flower buds for diabetes patients; it is also believed to improve the complexion in women[1].The same extract from Cassia auriculata flower was found useful in reducing blood glucose levels among pre-diagnosed Type 2 Diabetes Mellitus clients. The flower extract showed that there was significant reduction fasting sugar levels compared to pre- administration level. This can be recommended as an inexpensive option in various nursing settings. Cassia auriculata flower extract properties effectively reduce blood sugar. It keeps you cool by causing water loss, therefore it can be used instead of coffee or tea by diabetic people. To compare the efficacy of Cassia auriculata flower extract with other drugs in treating diabetes mellitus and hyperlipidemia, further studies should be conducted. The use of Cassia auriculata flower extract in the management of blood sugar levels and recommendations for conducting similar researches with large samples sizes in dif- ferent settings to generalize the findings are some of the study conclusions [2]. Avaram flowers can remove free radicals very well because they have many antioxidants, phenolics and flavonoids. These substances play a major role in protecting human body from oxidative stresses which is more common among people having diabetes. Moreover, methanol extracts from Avaram flowers have shown strong inhibitory effects on alpha-amylase giving hope to diabetes patients. In addition to flavonoids, proanthocyanidins, and b-sitosterol, there are various biologically active properties which make them beneficial for treatment of diabetics. Hence, it is worth noting that flavonoids help repair beta cells' damages while phenolic compounds aid significantly towards managing diabetes [3]. During preprocessing stage, RGB images are converted into grayscale using cvtColor function from OpenCV library as indicated by Kodali Dhanekula (2021). This conversion simplifies image data, reducing color channels from 3 to 1, thereby aiding the model in processing. By enhancing image quality and mitigating false predictions, this conversion con- tributes to improving the accuracy of the face mask detection model [4]. Rouhollahi et al. (2018), the cvtColor function from OpenCV is utilized to transition the image's color space. This conversion, specifically to grayscale, enhances object detection accuracy and simplifies the vision system's processing, benefiting from reduced memory requirements [5]. More et al. (2021), cvtColor is employed to convert RGB images to grayscale, a necessary step to simplify image processing and reduce computational complexity. Utilizing OpenCV- Python library, this conversion enhances efficiency by reducing color channels, aiding tasks like segmentation and feature extraction crucial for brain tumor detection [6]. Wang (2020), cvtColor is employed for image preprocessing. The function converts RGB images into single-channel grayscale, essential for compatibility with the VGG16 model. By extracting crucial features and minimizing noise, this conversion enhances image quality, thus improving accuracy in garbage recognition and classification [7]. Miyajima et al. (2012), cvtColor is utilized to perform grayscale transformation on input image frames. This

OpenCV API function simplifies subsequent image processing tasks by converting color images to grayscale. Integral to the processing flow described in the paper, this step pre- pares images for operations like edge detection or feature extraction, enhancing computational efficiency [8]. Cong et al. (2011) employ GaussianBlur due to its pivotal role in various medical imaging tasks like deblurring and registration. Implementing GaussianBlur on FPGA aims to enhance com- puting performance and energy efficiency across applications by leveraging shared kernels. Profiling reveals GaussianBlur as a computationally intensive bottleneck, prompting its FPGA implementation for performance optimization and acceler- ated medical image processing on the proposed platform [9]. Awasekar (2021) integrates GaussianBlur () to facilitate im- age thresholding for identifying vitiligo and ringworm color regions. Utilizing GaussianBlur () aids in refining the image by eliminating small color tones through erosion and dilation processes, enhancing the accuracy of disease detection within the blurred image [10]. Wang is employed to enhance image quality and diminish noise in the grayscale image derived from RGB input. This preprocessing step aids in feature extraction crucial for VGG16 model usage, ultimately boosting accuracy in garbage recognition and classification. By smoothing the image and reducing irregularities, Gaussian Blur contributes to improved model performance and higher recognition accuracy rates [11]. Miyajima et al. (2012) utilize GaussianBlur to reduce noise and smooth images, a common function in com- puter vision. They integrate it into their Courier toolchain to off-load tasks, including GaussianBlur, onto GPUs, resulting in a 2.06x reduction in execution time. This exemplifies how their toolchain and language, Trailblazer, simplify application accel- eration by extracting parallelism and off-loading specific func- tions to accelerators, demonstrated through GaussianBlur's effectiveness [12]. Zheng et al. (2019) employ GaussianBlur to smooth the original image, mitigating fuzziness and re- ducing noise inherent in B-mode ultrasound images. This smoothing aids in enhancing edge details crucial for accurate diagnosis. Additionally, the subtraction of the GaussianBlur image from the gamma-transformed result enhances image details, particularly edges, culminating in a visually clearer parathyroid image with improved diagnostic capabilities [13]. Xu, Baojie, and Guoxin (2017) explores the implementation of Canny edge detection using OpenCV, elucidating its steps and theory. Canny edge detection is renowned for its efficacy in image edge detection, facilitated by its adaptability to vary- ing thresholds and real-time processing capabilities, making it a staple in image processing applications [14]. Rong, Li, Zhang, and Sun (2014) employed the Canny edge detection algorithm due to its renowned accuracy and effectiveness in edge detection. They sought to enhance the traditional Canny algorithm by mitigating its susceptibility to noise and adapting to diverse image conditions. Their improved algorithm intro- duced gravitational field intensity, simplifying implementation while maintaining efficacy. Through MATLAB experiments on various image types, they demonstrated its superiority in preserving edge information and robustness to noise, using

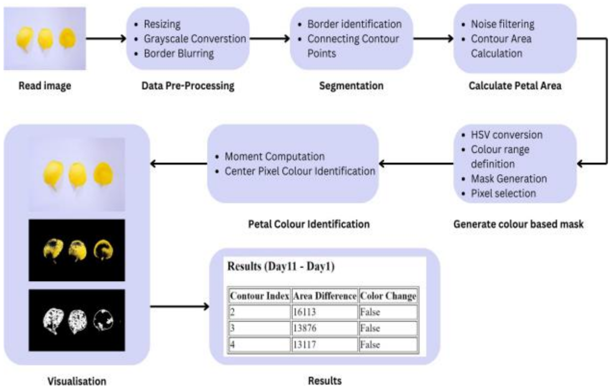

Fig. 1. Architecture

the traditional Canny algorithm as a benchmark for comparison [15]. Bao, Zhang, and Wu (2005) utilized the Canny edge detection technique due to its widespread acceptance and effectiveness in image edge detection. Their objective was to enhance the performance of the Canny edge detector by integrating the concept of scale multiplication. Through scale multiplication, they achieved improved edge localization accuracy and enhanced detection results compared to single- scale methods. Leveraging the well-defined criteria and estab- lished reputation of the Canny edge detector, they compared their scale multiplication-based approach with both the Canny edge detector and anisotropic diffusion edge detector (ADED) to assess its efficacy [16]. Shi and Ward (2002) employed the Canny edge detector due to its exceptional capability in maximizing the signal-to-noise ratio of gradients, minimizing false positives, and accurately marking edge points near their center. They found its ability to produce one-pixel wide edges advantageous for their image expansion method. Additionally, its proficiency in detecting small details with minimal noise, particularly at lower threshold values, aligned well with their requirements for precise edge detection. Overall, they selected the Canny edge detector for its capacity to produce sharp images, essential for their image expansion technique [17]. Zhou, Li, and Kneip (2019) incorporated the Canny edge detection algorithm into their visual odometry system, Canny- VO, to efficiently track and align edge features extracted from images. Leveraging the algorithm's reputation for accurate edge detection, they utilized Canny edge features to improve the efficiency and accuracy of 3-D-2-D edge alignment, en- hancing the system's robustness against outliers and sensor noise. By utilizing Canny edge features in the registration process, they aimed to enhance the performance of their RGB- D visual odometry system, facilitating more precise camera motion estimation [18].

III. METHODOLOGY

A. Dataset Creation:

The workflow initiates with sourcing high-quality Senna Auriculata from various locations in Mysore. Petals are then carefully plucked and placed under different environmental conditions. Observations are made over 11 days, capturing images with a Canon 1500D camera.

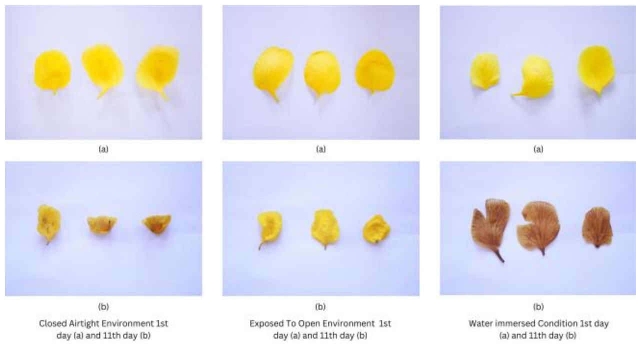

Fig. 2. Dataset

B. Data Pre-Processing:

The images, initially sized around 6000 x 4000 pixels, are resized to 960 x 540 pixels using the resize method of cv2 due to their large size. Initially in BGR format, they are converted to grayscale using the cvtcolor method. The image edges are then blurred using GaussianBlur through the Canny method, aiding in border identification.

C. Segmentation:

The image segmentation is achieved using the dilate method of cv2 in conjunction with the Canny method, which facilitated border identification, with a single iteration. Contour points are then connected using the findContours method of cv2, employing CHAIN_APPROX_SIMPLE.

D. Calculate Leaf Area:

The contour areas are calculated using OpenCV's con- tourArea function, with a constraint to ensure that the areas fall within the specified range of 6000 to 80000 square units to filter out noise.

E. Generation of color-based masks:

Colour-based masks are generated by converting images to RGB and then to HSV colour spaces for improved colour isolation. Predefined colour ranges for yellow and brown are utilized to create binary masks, which are combined to highlight areas of interest. The resulting masked image retains only pixels within these specified colour ranges.

F. Identifying the petal colour:

Colour analysis is conducted on detected contours, wherein the central pixel within each contour is identified by leveraging moment computation and pixel colour retrieval techniques. Subsequently, this pixel serves as the

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representative colour of the contour, effectively characterizing it, such as in the determination of petal colours.

G. Calculation of Difference in Petal Area and Identification of Color Change:

The area difference is computed by subtracting the contour area of the Day11 image from that of the Day1 image. Subsequently, the Day11 image is used to determine whether there has been a color change in the petals, specifically checking for a transition to brown using predefined color ranges. If a color change to brown is detected, the value “True” is assigned; otherwise, “False” is assigned.

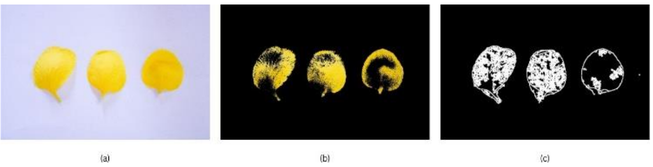

Fig. 3. (a) Orginal Image, (b) Masked Image, (c) Dilated Image

H. Identification of optimal storage environment:

The mean area difference for three petals in each environment is computed. Subsequently, the count of petals exhibiting a colour change is determined for each environment. The average of the area differences and the counts of colour- changed petals are ranked separately. The optimal storage condition is determined by calculating the sum of both ranks in each environment and identifying the lowest sum.

IV. EXPERIMENT AND RESULT

The experiment aimed to assess the optimal storage condition for Senna Auriculata. The workflow consisted of several key stages: Dataset Creation, Data Pre-Processing, Segmentation, Calculation of Leaf Area, Generation of Color-based Masks, and Identifying the Petal Color. Senna Auriculata petals were collected from diverse locations in Mysore and subjected to varying environmental conditions over an 11-day period. Images of the petals were captured using a Canon 1500D camera. The captured images, initially of large size (6000 x 4000 pixels), were resized to 960 x 540 pixels using the resize method of cv2. Subsequently, they were converted to grayscale and blurred using GaussianBlur to facilitate border identification. Image segmentation was performed using the dilate method of cv2 in conjunction with the Canny method. Contour points were connected using the findContours method of cv2 to identify petal borders. The areas of the identified con- tours were calculated using OpenCV’s contourArea function. A constraint was applied to filter out noise, ensuring that the areas fell within the specified range of 6000 to 80000 square units. Color-based masks were generated by converting images to RGB and then to HSV color spaces. Predefined color ranges for yellow and brown were utilized to create binary masks, highlighting areas of interest. Color analysis was conducted on the detected contours to determine the petal color. The central pixel within each contour was identified using moment computation and pixel color retrieval techniques.

Table I: Closed Air Tight Environment Results

Contour Index	Area Difference	Color Change
4	16697	True
5	23250	True
6	16290	False

Table II: Exposed to Open Environment Results

Contour Index	Area Difference	Color Change
2	16113	False
3	13876	False
4	13117	False

Incorporating the findings from the conducted experiment, it highlights significant insights into the preservation of flower petals, particularly focusing on Senna Auriculata (Avaram Poo). Through meticulous analysis of various conditions, it was observed that keeping flower petals in an open condition remarkably maintains their structure and color. This preser- vation is evidenced by the lesser reduction in contour area compared to petals subjected to covered or water conditions, indicating better retention of the petals’ original shape and size. Moreover, the vibrant color retention observed in petals exposed to open air further underscores the benefits of this condition, contrasting with the diminished color quality noted in petals subjected to covered or water conditions. This com- prehensive examination underscores the importance of envi- ronmental factors in preserving the texture and appearance of flower petals, offering valuable insights for botanical research and floral preservation practices.

V. CONCLUSION

This research findings shed light on the crucial role of environmental conditions in preserving the structural integrity and color vibrancy of flower petals, with a specific focus on Senna Auriculata. The conducted experiment showcased that maintaining petals in an open condition yields superior preservation outcomes compared to those subjected to covered or water conditions. The observed lesser reduction in con- tour area and enhanced color retention in open environment conditions highlight the significance of exposure to natural elements in maintaining the original characteristics of flower petals. These findings not only contribute to our understanding of floral preservation but also hold practical implications for botanical research and horticultural practices. By emphasizing the importance of

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environmental factors in petal preservation, this research underscores the need for careful consideration of cultivation and storage conditions to ensure the longevity and visual appeal of floral specimens. Furthermore, the insights garnered from this study provide valuable guidance for floral enthusiasts, researchers, and practitioners alike in their efforts to maintain the aesthetic and structural quality of flower petals in various contexts.

Table III: Immerced in Water Environment Results

Contour Index	Area Difference	Color Change
7	4142	False
8	-14730	False
9	3852	False

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