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Application of Digital Image Processing to Predict the Diameter of Chrysanthemum Flowers Ready to Harvest

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Abstract: Since 1940, chrysanthemum was developed commercially. Potentially, the cut chrysanthemum commodity still has problems in its development. Chrysanthemum flower production scheduling is needed to increase the quantity, quality and continuity of chrysanthemum production according to market demand. This happens because usually managers or entrepreneurs only harvest flowers en masse without seeing some flowers that should not be suitable for harvesting are also cut off. Therefore, it is detrimental to the manager itself and reduces the quality of the chrysanthemum flower products that are sold. The solution to the existing problem is that there is a need to observe flowers by applying precise agricultural technology according to the times to ensure the bloom time. By knowing this phase, the flower harvest period can be predicted correctly so that the fulfillment of market demand can be met appropriately. Observations in this study use digital image processing with the threshold method, which is then used as a basis for predicting the diameter of chrysanthemum flowers ready for harvest, hopefully this will help farmers or chrysanthemum managers to optimize their harvest. The results showed that the data image observation as a whole experienced the percentage of missing data or errors with possible causal factors due to the density of storage traffic, the effect of lighting, humidity and air temperature. In addition, the use of "image processing" to find the diameter of chrysanthemum flowers ready for harvest has succeeded in approaching the actual condition, although it has not been tested in other varieties.

1. Introduction

Ornamental plants are the leading horticultural commodities that are most in demand by the public because of their beauty and benefits [1] [2]. The benefits of ornamental plants in general can be used as aesthetic sources, hygienic plants as a source of C02, climatological plants, protective plants, hydrological plants, orological plants, edaphic plants, ecological plants, educational plants, poeksosbud and pharmacological. Therefore, at present, ornamental plants have become a trend or lifestyle in society. Chrysanthemum (Chrysanthenum) is an ornamental plant that is very popular in Indonesia today [3] [4]. The advantages of the chrysanthemum plant include having various types of flowers with various shapes, and long-lasting bloom time accompanied by a lot of essential ingredients that can be used as medicinal agents [5] [6], [7], [8]. The intensity of flower color on chrysanthemum is due to the accumulation and combination of pigments [9]. The pigments in the various colored petals are classified into carotenoids and flavonoids [10]. In addition, the flowering of chrysanthemum can also be adjusted

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with the addition of light treatment so that harvest time can be carried out throughout the year [11]. Until now, the demand for chrysanthemum is in the top rank compared to other types of cut flowers. The total amount of cut chrysanthemum production in 2018 reached 488.18 million stalks, followed by roses with 202.06 million stalks production, and tuberose with 116.91 million stalks production [12]. Therefore, this plant has enormous potential to be developed. This potential will be optimized if the cultivation process including the management [13] of planting media, planting techniques [14], fertilization, light intensity, air temperature, and so on can be done optimally as well. Chrysanthemum plants that grow well will be able to be harvested when the planting age has entered 90 days.

Besides having the potential, the commodity of cut chrysanthemum still has problems and obstacles in its development. Chrysanthemum flower production scheduling is needed in order to increase the quantity, quality and continuity of chrysanthemum production in accordance with market demand because in fact there are still often chrysanthemum managers or entrepreneurs who cannot say how much and when the chrysanthemum flowers will be ready to be harvested. This happens because managers or entrepreneurs only harvest flowers en masse without seeing some flowers that should not be suitable for harvesting are also cut off. This is clearly detrimental to the manager itself and reduces the quality of the chrysanthemum flower products that are sold. In previous studies, prediction of chrysanthemum harvest at age and introduction of traditional morphology such as flower diameter and flower color.

One solution to the existing problem is the need to observe the flowers by applying precise agricultural technology according to the times to ensure the bloom time. By knowing this phase, the flower harvest period can be predicted correctly so that the fulfillment of market demand can be met appropriately. The harvest staging is when the flowers are half-bloomed or 3-4 days before full bloom or during the 6-10 day coloring phase before full bloom. Spray type 75-80% of the whole plant. The plant is ready to harvest after 3-4 months after planting [15]. Description of several varieties of cut flower chrysanthemums [16] including Reagent, Salmon Impala, Puma, Yellow Puma, and Peach Fiji.

Precision agricultural technology that can be applied such as digital image processing technology [17] to predict the diameter of ready-to-harvest chrysanthemums. This method is also widely used for plant identification [18, 19]. With the use of this method, plant morphological information becomes two-dimensional image information so that it can substantially simplify the process of collecting plant phenotypic data [20]. This technology has been applied to the [21] research for the rapid introduction of various types of chrysanthemum cultivars. In this study the researchers were able to quickly obtain the top 5 cultivar information to predict the cultivar name with the appropriate cultivar image from the system. In addition, recently uploaded images can be reused as input samples for subsequent literacy, which continues to improve the generalizability performance of the model.

The stages in applying this technology include:

1.1. Image

Importing images is the first step in data requirements. The data obtained from photos are in the form of images, taken using a camera that is placed on a krissan flower with a distance of approximately 1 meter. The chrysanthemum flower image is then read and processed by the system then converting it into a 3-dimensional matrix in RGB color space. The image used is in the Jpg format, which has a pixel of at least 550 times 550. A higher pixel density allows for a more perfect level of accuracy in the next process. Using the imread function converts it to a matrix which is 550x550x3 (Rows x Columns x RGB). The final dimension (RGB) corresponds to the intensity level of red, green and blue [22]. Then use the imshow function to preview the resulting image.

1.2. Thresholding

It is an image segmentation method that is used to separate objects from the background in an image based on differences in brightness or darkness. The area around the image that tends to be dark will be made darker so that it has a more perfect intensity value (0) or perfect black, while the area around the image that tends to be bright in intensity will be enhanced by being made lighter so that it becomes

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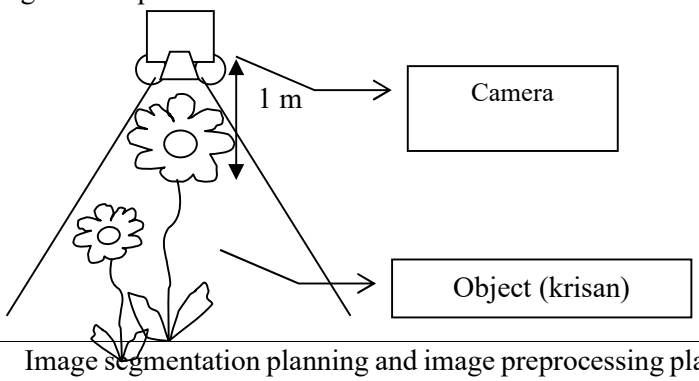
perfect white (1) [22]. This process divides the image into binary images to differentiate the background from the desired object.

1.3. Continuous Segmentation (removes noise)

The resulting initial segmentation will have less noise and we will need to clean up the image significantly to improve the accuracy of our diameter measurement. The procedure is taken to clean the image and provide a more uniform blob for analysis. The blobs in this image are collections of white pixels that touch to create a cohesive and distinct object

2. Methods

Tabel 1. Methods

The flow diagram	Description
Literature review	Looking for information about chrysanthemum plants, either through books or the internet.
Identification	a. Making a shooting tool at a chrysanthemum green house b. Collecting image data as a database of flowers through shooting c. Identification of the age of the chrysanthemum flower from the image data captured 
System Design	a. Image segmentation planning and image preprocessing planning b. Segmentation planning 2 c. Diameter calculation planning
Scripting	Implementing through programming language preparation, partial system
No Testing, ? Yes	Program trials, and program revisions
Analysis	Analysis of the final results of the program to the initial data of flower images
Report	Make a report

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3. Result and Discussion

This research uses MATLAB software to assist in the processing of imported images as a starting point for obtaining the initial object of the chrysanthemum flower to be processed. Use the imread command to read an image and convert it into a 3-dimensional matrix in RGB color space. The image used is a chrysanthemum taken at the location (Figure 1), which is an image measuring 456 x 342 pixels. The imread function converts it to a matrix which is 456 x 342 x 3 (Rows x Columns x RGB). The final dimension (RGB) corresponds to the intensity level of red, green and blue. Use imshow to view the resulting image in a new window.

Figure 1. Chrysanthemums are ready for harvest

Segment images into binary images to differentiate the background from the desired object. The first step is to divide the image into three images based on the intensity of each red, green and blue component in the image. It is a color based image segmentation. You can see from Figure 2 that the red plane is the best choice to use for Image Thresholding because it provides the greatest contrast between files.

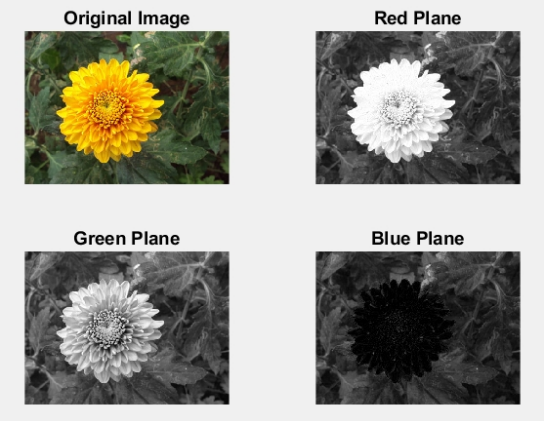

Figure 2. Image Thresholding

The desired object (foreground) and background. Image Thresholding takes the intensity image and converts it into a binary image based on the desired level. A value between 0 and 1 determines which pixel (based on the value) will be set to 1 (white) or 0 (black). Set the increment value to 0.01 and choose the best value for the threshold. Threshold at 0.37. You can see that image 3 has been segmented between the object we want to measure and the background. Advanced segmentation (Remove noise) as can be seen from the top left image in Figure 2, there is a little "noise" and we need to do it. Significantly cleans the image for improved diameter measurement accuracy. Figures 2 and 3 show the procedures performed to clean the image and provide a more uniform appearance for analysis. The blobs in this document are collections of white pixels that are touched to create a cohesive and distinct object file.

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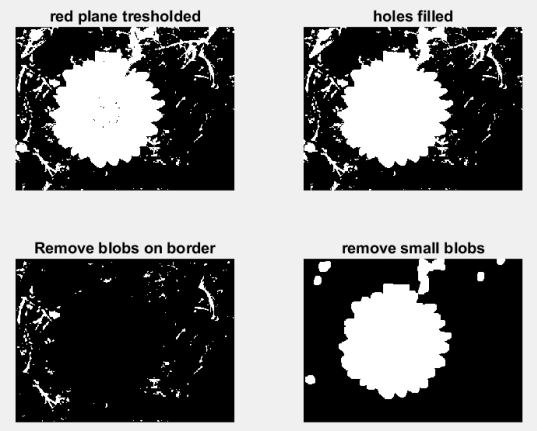

Figure 3. Advanced segmentation

Advanced Segmentation (Remove noise) As you can see from the top left image in Figure 2, there is less "noise" and it is necessary to do significant image cleaning to improve the accuracy of the diameter measurement. Refer to Figures 2 and 3 for the procedure performed to clean the image and give it a more uniform appearance for analysis. The blobs in this document are collections of white pixels to create a cohesive and distinct object file.

The regionprops function will provide the MajorAxisLength of the blobs in the image. As can be seen, the diameter is 228 pixels, or 6.0325 cm (Figure 4). Ready-to-harvest chrysanthemums have a diameter of around 6 cm, so the segmentation and threshold systems can be used to help measure the diameter of chrysanthemums.

Figure 4. The measurement results of the chrysanthemum diameter

The equipment needed to get the chrysanthemum flowers flower object image can be seen in the table below:

Tabel 2. Wiring on microcontrollers and raspberry devices

Controller	PIN	Device
ATMega328	A4, A5 (I2C)	Lux Sensor
	2	DHT22
	A1 (analog In)	Soil Moisture
	A4, A5 (I2C	OLed LCD
Raspberry Pi	2,3	Led Status
	Aux pin	Pi Camera

4. Conclusion

Observation of the data image as a whole experiences a percentage of data that is missed or error with possible factors due to storage traffic density, lighting effects, humidity and air temperature. The use of

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"image processing" to find the diameter of chrysanthemum flowers ready for harvest has succeeded in approaching the actual condition, although it has not been tested in other varieties.

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