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Automated Flower Harvester Design and Implementation using Image Processing

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Abstract: Developing and designing an autonomous system capable of harvesting flowers is the primary goal of this work. When the apparatus described in this article is used, the flowers will be removed from the plant in excellent condition, saving time compared to harvesting them by hand. Flower harvesting automation has been limited to huge blooms like tulips in recent days. As a result, there will be a need for smaller flowers like the rose to be harvested. There is a solution to this issue and it is less expensive than harvesting manually. The watershed algorithm is utilized to identify the blooms in this technique. The recognized flower is compared to other flowers in the database using the histogram distance computation. It will be possible to determine the centroid of a flower and how far away from the centroid to cut its stem if the detected flower matches 70-80% of the expected one. A microprocessor sends a signal to the robotic arm, which then cuts the matching blossom. For agricultural reasons, this initiative seeks to build a harvesting method that is both efficient and affordable.

Keywords— Database Management System (DBMS), Cost Coefficient, Robotic Arm, Manual Harvesting, Centroid.

1. Introduction

Picture processing is a method for extracting and enhancing specific information from an image via the analysis and manipulation of that image. Images are used as input in image processing, and the output might be another picture or a specific characteristic or feature of the original image. Image Research in computer graphics, engineering, etc. is heavily influenced by computer vision and computer graphics. Analog and optical image processing may also be used, although digital image processing is the most often used. Analog technologies are employed in the production of physical media, such as photos. Only the spatial coordinates (x, y) are distinct in a digital picture. Digital photographs are less expensive to produce and need less time to edit. The field of image processing encompasses a wide range of techniques and interpretations. Association using visual approaches is a critical tool in image processing. In order to process the picture, the image processing analysts use collateral data and their own experience. It is a real-time embedded system when a computer system is linked to an external environment through sensors, input-output interfaces and actuators, which may include biological or physical items of any shape and form. Real-time interaction with the outside world necessitates meeting certain timing and restriction requirements. Smaller blooms may be harvested more easily using this autonomous system. Motors, sensors, accordance avo,idance, gripper, and robotic arm are all part of this system for collecting flowers at the proper moment and avoiding collisions.

Advantages:

In order to harvest flowers without damaging them, (a) this system will enable you to do so without recharging (b) this system can function for longer (c) it will take less time to collect flowers compared to hand harvesting

In (d), when the cameras' relative distances were 100 mm apart, the best match was achieved.

Disadvantages:

You won't get an exact picture of the flower if it's detected

(b) It takes a lot of time and effort.

High matching error might occur when the distance between two objects is larger than 100mm.

In terms of usability, it's d.

E) It is tough to remove the natural backdrop and yet get an accurate picture.

2. SYSTEM DESCRIPTION

It is possible to recognise flowers using a watershed algorithm in this approach. The following description is provided as a result of the algorithm.

The input array values beyond the array's limits are presumed to be identical to the closest array boundary value in the repeated filtering.

The IM filter function treats the data types as image arithmetic functions. The zero-padding artifacts around the image's borders are eliminated by this IM filter. Replicating borders in this manner is essentially the same as padding the borders. To do this, the IM filter uses an extra input, "replicate".

Thirteen equals filter(I and H) with the option to "replicate"; figure; show(13) and title("filtered with border replication").

In order to figure out the gradient, you must:

The term "image gradient" refers to a shift in an image's hue or intensity in one direction alone. In image processing, the picture gradient is a fundamental building component.

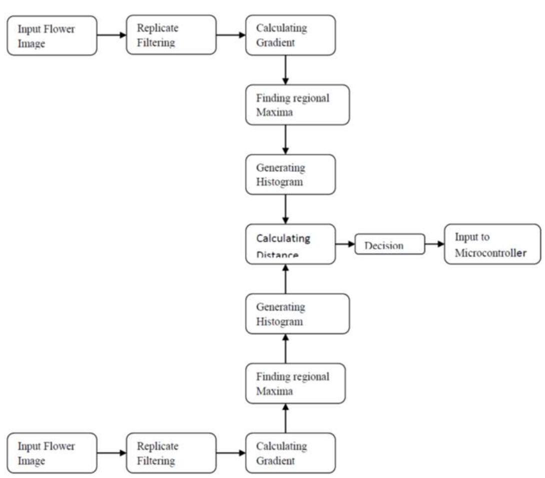

Fig.1: System description

Vertical and horizontal edges may be seen by using this gradient in the picture. Horizontal gradients are employed to identify the vertical edges, and the image's extreme gradient values are used to derive the threshold values. The difference in image gradient across columns was used to calculate the horizontal gradient.

As a consequence, the output of each gradient computation may be combined to produce the final picture. A gradient picture is the result of merging horizontal and vertical gradients.

3. Finding region maxima:

In general, there will be a single global minima or maximum for each area. Using the picture troughs and peaks as a guide, morphological reconstruction uses marker images.

You may identify regional maximums by using BW=imregional(I).

External border pixels have intensities that are smaller than t, hence the regional maxima are composed of pixels with constant intensities (t) and their linked components (c).

The grayscale picture will be sent to imregionalmax as an input, and an output binary image will be returned. All other pixels in the output picture are set to zero except for the regional minima or maxima.

To dilate a grayscale picture using this method, just a single-pixel peak filter is needed.

A histogram may be generated by:

The image histogram is a graphical depiction of the tonal distribution of a digital picture. This graph shows the pixel count for each tonal value.

The histogram for the intensity image(I) must be calculated and shown using this function. When creating a histogram, the number of bins is determined by the picture type.

n is the number of histograms (Y)

n is equal to hist (Y,X)

n=hist(Y,bins)

This is a histogram of [n,xout].

Distribution of data values is shown.

In order to group the elements of the Y vector into 10 evenly spaced containers, the function n=hist(Y) is employed. This function returns a row vector containing the number of elements in each of the ten containers.

A vector x is used in the calculation of n.

With the help of patch graphics object, it is possible to change the graph's colours.

Distance=sqrt(mean((hist1-hist2)2))) where hist1 and hist2 are the input and database histograms, respectively, is used to determine the difference between the two histograms. When comparing the two histograms (hist1 and hist2), the root mean square error measure provides the best fit.

3. SYSTEM HARDWARE ARCHITECTURE

ARDUINO UNO, an AT-mega microcontroller, is utilised in this project. Fig. 2 shows a diagrammatic depiction of the system's components.

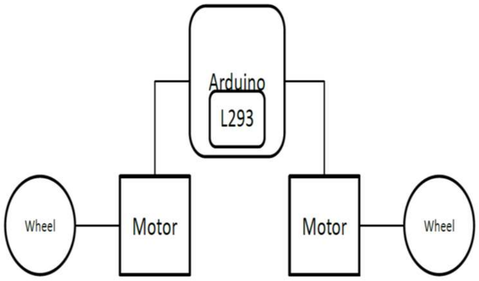

Fig 2. Block Diagram of Hardware Process

Robotic cutter arm:

The robotic arm cutter has movable blades that are controlled by the motor. The blade cuts the stem when the motor moves 180º.

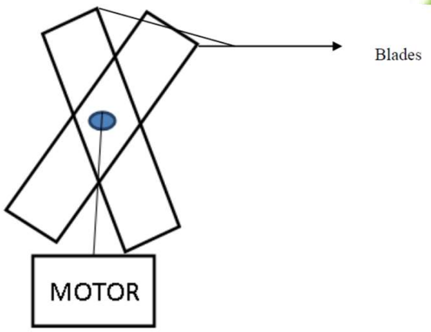

Fig 3. Robotic Cutter Arm With Motor

4. WATERSHED ALGORITHM

The AT-mega-based ARDUINO UNO microcontroller is used in this project. Figure 2 depicts the hardware of the system in diagrammatic form.
The watershed ridgelines are superimposed as white lines in the original picture using the following function.
The g2 and l2 are the watersheds of g2 and g3, respectively.
ALGORITHM:
The first step is to create a grayscale picture from an RGB image.
Second, create a Sobel filter (hy).
Step 3: Iy applies the supplied value to the picture using the duplicate generate IM filter (hy).
Ix uses the replicate generate IM filter to apply the supplied value (hx") to the picture.
Step 5: The gradient magnitude of the filtered picture is determined using the method provided below, gradmag=sqrt(Ix2.2+Iy2.2); Step 6: The area maxima are calculated and overlaid on the original image.
Using the picture created in Steps 1-6, a histogram may be generated for it.
All of the previous stages are repeated on the database photographs.
It's at this point that histogram comparisons are made, and the distance between samples is determined.
Once the centroid of the picture is determined to be 60 percent or higher, the cut location is determined.

5. RESULTS AND DISCUSSION

The simulation result for the same flowers are given by,

Fig 4. Gray Scale of Input Image

In fig. 4 the RGB image has been converted into a gray-scale image for making the processing easier.

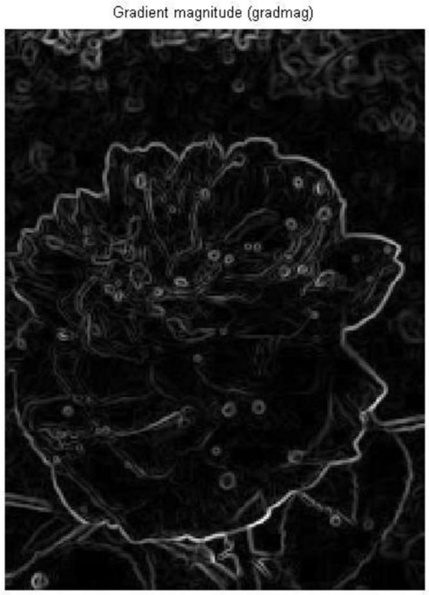

Fig 5. Gradient Magnitude of the Gray Scale Image

In fig. 6.2, us , the gradient magnitude of gray-scale image has been found using the below formula.

Gradient magnitude= sqrt(Ix2.^2+Iy2.^2).

Fig 6. Regional Maxima of opening by reconstruction

Fig 7. Regional Maxima Superimposed of Orginal Image

Histogram of similar images:

For similar images, the histogram plots are given below.

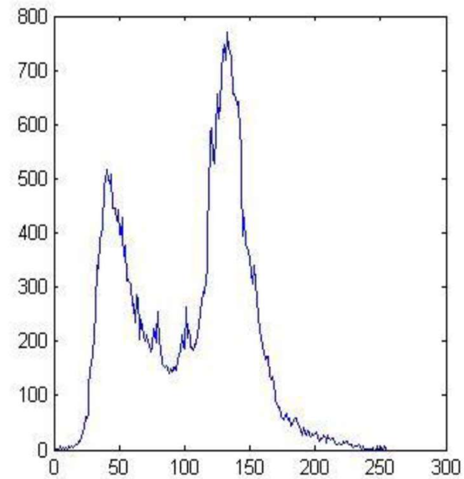

Fig 8. Histogram of Input Image

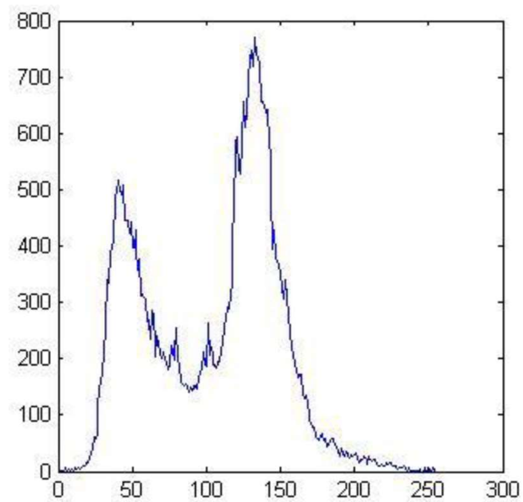

Fig 9. Histogram of output Image

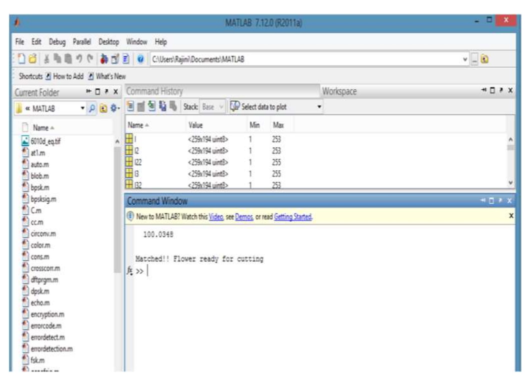

Fig 10. Percentage of Matching of Same Flowers

The simulation result for an exact match in flowers is given below. Here the flower which is not present in the database is given as input and compared with the flower in the database, and the result is as follows.

6. Conclusion and future work

AT-mega microcontroller, or ARDUINO UNO, is utilised in this project.. System hardware is shown in Fig. 2 using a diagrammatic depiction

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