

Features Based Fruit Gradation System using Image Processing

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Abstract: An automatic fruit quality inspection system for sorting and grading of fruits is discussed here. The quality of fruit is an essential factor for the customer, and so it is essential for marketing a uniformly high-quality fruit. The manual inspection system for sorting is replaced in this system. The system consists of a combination of software and hardware. Open source software is used as it is freely available. For covering a total area of fruit, it is placed in a rotating disk. The system performance mainly depends on thresholds used for size and color. Though the value of size and color will vary with a different image but the developed system did not require adjustment in threshold value for grading of fruits. This system helps in speed up process, improve accuracy and efficiency. The system accuracy is about 92%. The image processing is carried out, and features such as color, size, and glare are extracted and processed for quality of fruits. Servo motor is used for movement of rotating disk. The fruit is graded in two varieties.

Keywords: Anaconda Software, Jupyter Notebook, Servo motor, Camera, Image processing

I. INTRODUCTION

In India agriculture is most important for a growing economy. Different types of fruits are produced in India. In India, all the pre-harvest and the post-harvest process are done manually with the help of labour and this processing quite consuming, less efficient. The manual procedure is very tedious, less productive so to get accurate results automation is required. The post-harvest procedure incorporates arranging and evaluating organic products. Diverse quality components are considered for arranging and reviewing of natural products. These elements are inner quality variables and external quality components. The external parameters are edge, size, color, and internal parameters are test, sweetness, flavour, aroma, nutrients are present in fruits.

The system uses images preparing the procedures for characterizing natural products. Many brilliant natural products intermixed with low quality once are treaded or at a low cost because of the slowpoken method for quality discovery and arranging the task. Programming improvement is profoundly vital in this characterisation arrangement of natural products. The flow of system is structured over Anaconda software to assess the evaluating of the fruits. The nature of organic products play vital for the buyers and become the necessity from the providers to give natural products evaluated requirement quality. Thus, in a previous couple of years, natural products reviewing frameworks have set up satisfy the necessities of the organic products preparing the industry assessment. Other than that the procedure of the organic product includes a few stages that can buy and large be ordered in previewing, arranging, bundling, transporting and capacity. The reviewing is considered as the most critical strides towards the exclusive requirement of quality of fruits.

II. LITERATURE SURVEY

Ms Rupali S Jadhav has proposed a fruit quality management system based on image processing the system takes ARM 9 main processor and develops the size of fruit detection using image processing on the embedded platform [1].

Mohammad A. H. Ali has proposed the automatic fruit grading system the system captures the images of fruit using a camera and fruit is placed on rotating disc. For image processing, MATLAB is used, and grading is done [2].

Manali R Satpute, Sumati M Jagdale has proposed an automatic fruit quality inspection system author has introduced a system which finds the color and edge detection. For color detection, the author used RGB to gray conversion, and canny detection is used [3].

Guo Feng, Coa Qixin has proposed a study on a color image processing based Intelligent fruit sorting technique the author has proposed a system which finds the color of fruit using RGB to Ohta color space and Bayes classifier is used for sorting of fruits [4].

Susovan Jana, Saikat Basak, Ranjan Parekh have proposed automatic fruit recognition from a natural image using color and texture features author has proposed a system which extracts features like color and texture for that GLCM and SVM classifier is used features extracted from the training dataset [5].

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Asif Khan, Imran Khan has proposed Vision based classification of fresh fruits using fuzzy logic, the author has proposed a system which finds the size, color, and edge of mango using Fuzzy logic interface rule they are defining the quality of mango [6].

Deepak Khot, Dr M. Sankar have proposed fruit quality recognition by external appearance and internal flavour factors. In this ANN algorithm used for fruit quality detection [7]. Anusha Sanga, Shweta Shinde, Suraj Shaha has proposed Fruit sorting robotic arm based on image processing. Picmicrocontroller and the robotic arm are used for quality of fruit color, size, and hydration contents are considered.

R. Swarnalakshmi, B. Kanchanadevi have proposed system on a review on fruit gradation system for quality inspection. They have used image spectroscopy, fuzzy interface system, neural network and image processing for fruit quality detection[9].

Lekha Bhausahab Kachare has proposed Object sorting robot using image processing. ARM7 processor and real-time image using camera fruit detection are used [10].

Usama Mokhtar, Mona A.S. Ali has proposed tomato leaves detection approach based on support vector machine. k-mean clustering and geometric features are used for identifying disease and color [11].

III. PROPOSED METHODOLOGY

A. Algorithm

Algorithm for grading of fruits:

1. Capturing of image.
2. Pre-processing the image.
3. Feature Extraction.
4. Compared with the threshold value.
5. Display the result.

The proposed system is designed to grade fruits quality-wise. Image acquisition, pre-processing, feature extraction, and grading of fruits is processing flow. USB camera is used for capturing the images of fruits for the covering the full area of the fruit servo motor is used which will rotate fruit in 180 degrees, and grading is based on their external features. Anaconda software is used for image processing, and python language is used for programming.

• COLOR DETECTION

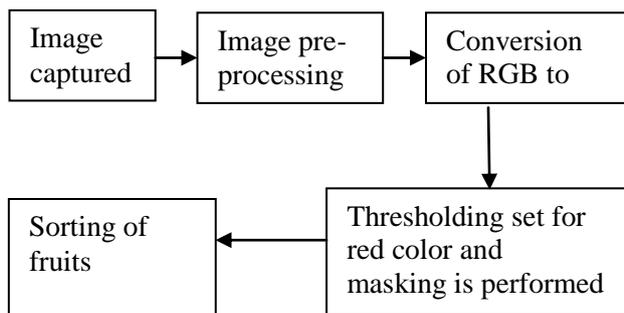


Fig. The processing flow of Color Detection

Color detection is done after capturing the image from the camera. Fruit color detection according to RGB values of fruit is graded. The method used for color detection is that the RGB image is converted into HSV. After that masking of the image is occurred red color pixel value is compared with a threshold value.

• SIZE DETECTION

For size detection morphological operation such as dilation, erosion is performed on the captured image. For size detection, major axis and minor axis length are calculated by using Euclidian distance method. The formula of Euclidian distance is:

$$\text{Dist}=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

B. Hardware development

This system consists of a rotating disk, servo motor for capturing the full area of image Arduino nano is used to control the servo motor.



Fig.2 Setup of project

IV. Method

Grading and sorting are done based on outer parameters. Color detection and size detection is done based on thresholding value. Based on quality fruit is graded into two grades.

V. RESULTS AND DISCUSSION

Table 1. Results of grading fruits

Parameters	No. of Samples	Correctly Sorted	Accuracy
Color	35	32	91.42%
Size	35	33	94.28%
Glare	35	31	88.57%

For grading fruits, we tend to check 80 samples and set threshold values for it. While checking results of 35 samples, for color parameter color pixel value of 32 samples goes beyond threshold value and for size parameter out of 35 samples size of 33 samples goes beyond a threshold value. Hence for color parameter accuracy is 91.42% and size parameter accuracy is 94.28%. Color and size based image processing algorithm can provide a more accurate result for gradation.

VI. CONCLUSION

In this paper, image processing is used for detecting defected fruits for sorting and grading of fruits. The automatic fruit grading system we developed. The automatic fruit quality detection system save time, reduce the effort of workers and give accuracy more than manual sorting. Color and size parameter system gives more accuracy as compare to glare parameter as luminanace effect will hamper the glare of fruit.This system will be helpful for farmers and exporters which will give a boost to their economic interest as overall.

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