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Automatic Fruit Quality Detection System

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Abstract - This paper presents the recent development in automatic vision based technology. Use of this technology is increasing in agriculture and fruit industry. An automatic fruit quality detection system for sorting and grading of fruits and defected fruit detection discussed here. The main aim of this system is to replace the manual inspection system. This helps in speed up the process improve accuracy and efficiency and reduce time. This system collect image from camera which is placed on conveyor belt. Then image processing is done to get required features of fruits such as color and size. Defected fruit is detected based on image pixels. Sorting is done based on color and size.

1. INTRODUCTION

India is an agriculture country. Different types of fruits and vegetables are produced in India. India is at second number after china in production fruits. In India all the pre-harvest and post-harvest process are done manually with help of labor. Manual process is very time consuming, less efficient so to get accurate result automation in agriculture industry is needed. The post- harvest process includes sorting and grading of fruits. Different quality factors are considered for sorting and grading of fruits. These factors are internal quality factors and external quality factors. The external quality factors are texture, shape, color ,size and volume, and internal quality factors are test, sweetness, flavor, aroma, nutrients, carbohydrates present in that fruit[3].

Automation is playing important role in day to day life. In India more than half population depends upon agriculture. Their main source of income is agriculture. Exporting of fresh fruit is increased day to day from India. People are very conscious about their health; they prefer only fresh, good quality fruit.

Texture, Color and Size are the important parameters for fruit quality identification. The color recognition is very important process in ripeness detection. The ripeness detection is external quality factor. But texture is also very important. Because of texture defected fruit can be recognized. Texture analysis detects the non-uniformity of fruit outer surface. The size is also important parameter. It clearly seen parameter all customer select fruit based on size.

2. LITERATURE SURVEY

Surprit kaur. Akshay girdhar, and jasmine Gill, Sringer nature singapour 2018[1]. This paper presents a vegetable grading and sorting system based on computer vision and image processing. For this work, tomatoes have been used sample vegetable. A total of 53 images were acquired using own camera setup. Afterward, segmentation using Otsu's method was performed separate the vegetable from the background. The segmented images, thus obtained, were used to extract color and shape features. At last, grading and sorting were performed using back propagation neural network. The proposed method has shown an accuracy of 92% and outperformed the existing system.

Deepika Sharma, sharad D. sawant 2017[2], Designed the Grain quality detection system by Image processing system. In this paper, they have proposed a system that determines the quality of food. Initially, the grain samples run on the conveyor belt and then random images of grains are captured by the camera. The image processing algorithm is applied on the grain samples through MATLAB. The classification has been done according to color, shape and size.

Zhahida parveen, Mohamaad anzhar aalam, Heena shakir 2017[3].Designed a system Assessment of quality of rice grain by using optical and image processing. This paper represents a proposed system of an image processing technique using extended maxima operator to detect the chalky area in the rice. They also calculated the dimensions and color to classify rice grains. The experiment was performed on 22 sample images of rice grain to test the proposed method and was validated using visual inspection.

Manali R. Satpute, Simati M. jagdale, 2016[4] This paper represent An automatic fruit inspection system, this system collect image from camera which is placed on conveyor belt. Then image processing is done to get required features of fruits such as texture, color and size. Defected fruit is detected based on blob detection, color detection is done based on thresholding and size detection is based on binary image of tomato. Sorting is done based on color and grading is done based on size.

3. OVERVIEW OF SYSTEM

A. Block Diagram

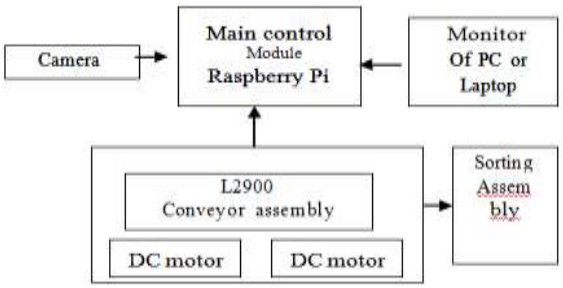

Fig. 1. Block diagram of System

B. Description

The Infrared sensor is placed on conveyor belt, when fruit is come in front of infrared sensor message will display as fruit detected then conveyor belt moves with small distance an stop when fruit come exactly in front of camera. Camera always in video mode. When fruit is detected the image processing is done on that image captures and color is detected. Red, Green, Yellow color are detected. The system is divided into hardware control and image processing. The image processing results is based on camera image. The results such color detected. Second part is hardware is controlled based on color detection.

The image processing is done by software OpenCv using a language python. The software is divided into two parts first one is for image analysis and other is for controlling hardware based on image processing results. As per Fig 1 the system is operated in two different scenarios in first the image is captured with camera the all the image processing is done in the control module. All the process are shown on monitor and then based on decision taken by control module. The conveyor assembly is operated.

C. Processing flow

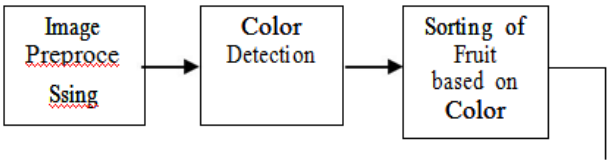

Fig: Fruit sorting and grading flow

D. Image Preprocessing

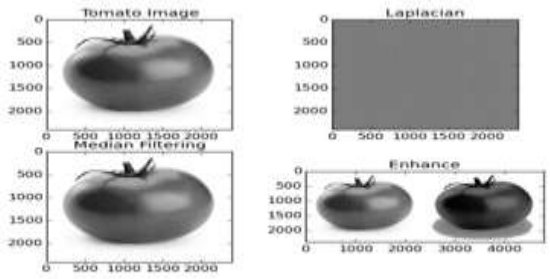

Fig3.Image Preprocessing

In the process of fruit sorting and grading to work system efficiently proper image acquisition is very important. The image is captured with camera that image is with noise and its features are not clearly seen so image preprocessing is done on that image.

In this project the features required are color, texture and size. To get exact feature preprocessing is done on acquired image. The main aim of image processing is an improvement of image so that unwanted distortions are suppressed and enhance image features which are important for further processing.

The basic steps of preprocessing are first convert RGB image to gray scale image. Then image histogram equalization is applied on gray image. This helps in adjusting image intensities in order to enhance contrast. Remove noise with filter, here we use median filter for removing noise here laplacian is used for edge detection as it highlights the region with rapid intensity change. So this enhanced, noise free, filtered image is ready for further processing.

E. Defected Fruit Detection

This is the flow for defected fruit detection. The image taken is RGB image. Firstly this image is converted to gray scale and the edge detection is performed and mask image is formed.

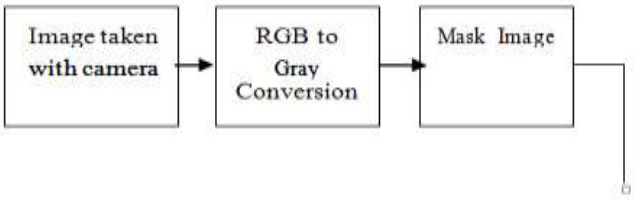

Fig4: Flow of defected fruit detection

Another method used for defected fruit detection is that RGB image is converted to YCR color space. Then lower and upper ranges are defined. Then ranges of binary image are defined. Then convert single channel mask back into 3 channels.

F. Color Detection

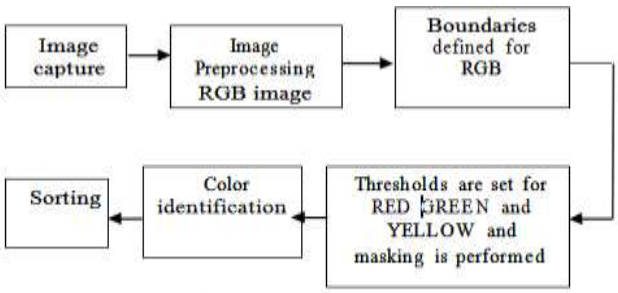

Fig5.Flow for color detection

The above figure.5 shows the flow of color detection based sorting of fruit. Image captured that is RGB image is given to preprocessing. Define the list of boundaries for BGR color. Apply loop over the boundaries. Find the colors within the specified boundaries and apply the mask. In the sorting of fruit is done based on color and grading is done based on both color and size.

4. DISCUSSION AND RESULTS

1. Input fruit image

Here is camera which is place over conveyer belt, camera is continuously on video mode and it continuously captures the images of fruits. We can also give direct input image to the system by using image processing to see the output. Here below shows input fruit image is captured by camera.

Fig 6(a) Captured image of banana fruit

2. Output mask image

After capturing image, that is RGB image is given to preprocessing. Then it defines the list of boundaries for BGR color. Apply loop over the boundaries. Find the colours within the specified boundaries and apply the mask.

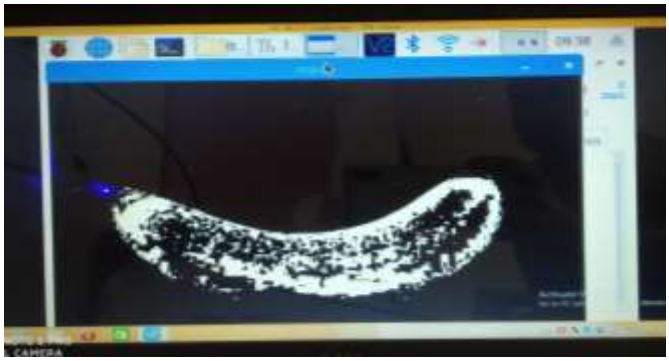

Fig 6 (b). Mask image of banana fruit.

3. Output of fruit quality

Here fruits qualities are divided into three types that are Q1, Q2 and Q3. Quality Q1 shows good quality, Q2 shows medium quality and Q3 shows low quality. This fruit showing quality2 i.e Q2, it means it is a medium quality fruit .Result of quality detection is below;

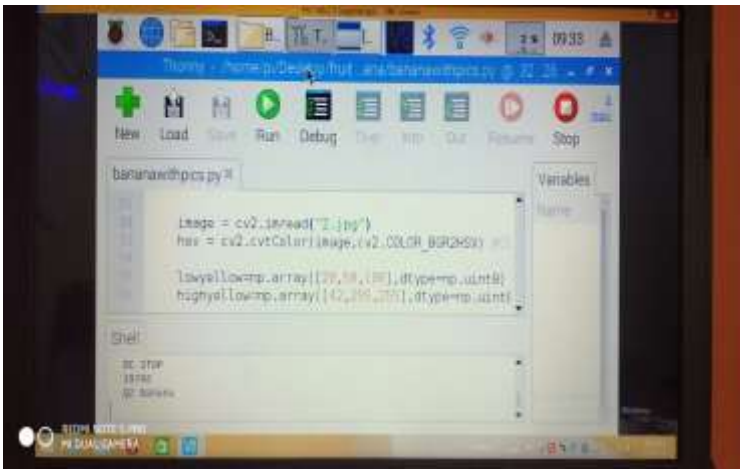

Fig 7(a) Output on Paython shell

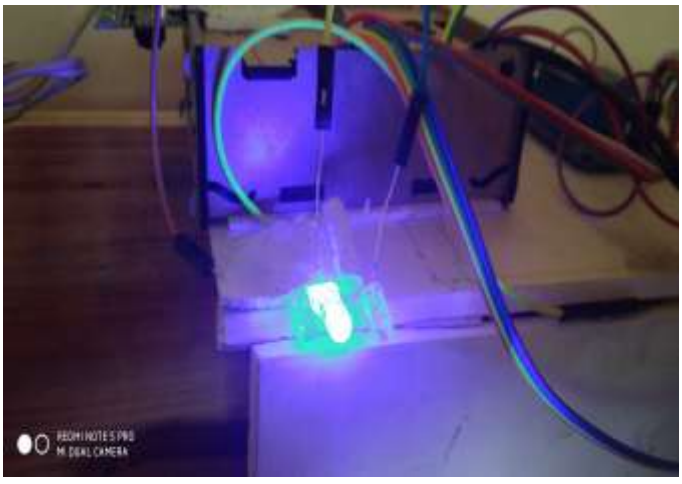

Fig 7(b) Output on System Hardware

5. CONCLUSION

In this paper automatic vision based system is discussed for sorting and grading of fruits based on its color and respectively. The test performed on banana for defect detection detects defected fruit. And for three different qualities good, medium and Low. The variation in speed of conveyor and light, camera resolution affects the system.

6. FUTURE SCOPE

Further design can be modified by increasing size of conveyor belt so that it is possible to perform quality inspection of large fruit than tomato, and increase accuracy of the system so that it can differentiate between artificial , hybrid color from original fruit color.

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