REVIEW ON COLOR BASED QUALITY ANALYSIS OF FRUITS FOR AUTOMATIC GRADING USING RASPBERRY PI

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ABSTRACT

Nondestructive quality evaluation of fruits is important and very vital for the food and agricultural industry. This project presents fruit quality detection system. The system design considers some features that includes fruit colors and size, which increases accuracy for detection of fruits pixels. On some fruits black spots exists because of fungus. These black spots can be identified with the use of image contouring technique. At present, most existing fruit quality detecting and grading system have the disadvantage of low efficiency, low speed of grading, high cost and complexity. IMAGE PROCESSING offers solution for the automated fruit size grading to provide accurate, reliable, consistent and quantitative information apart from handling large volumes, which may not be achieved by employing the human graders. The hardware prototype also created by using RASPBERRY PI ultra low power microcontroller.

KEYWORDS: *RASPBERRY PI, IMAGE PROCESSING, Conveyor setup, image contouring.*

1. INTRODUCTION:

In order to improve the fruits' quality and production efficiency, to reduce labor intensity, it is necessary to research nondestructive automatic detection technology. Fruit nondestructive detection is the process of detecting fruits inside and outside quality without any destructive, using some detecting technology to make evaluation according some standard rules. Nowadays, the quality of fruit shape, default, color and size and so on cannot evaluate on line by using traditional methods. With the development of image processing technology and computer software and hardware, it becomes more attractive to detect fruits quality by using vision detecting technology. At present, most existing fruit quality detecting and grading system have the disadvantage of low efficiency, low speed of grading, high cost and complexity. So it is significant to develop high speed and low cost fruit size detecting and grading system.

Food and other biological products are valued by their appearance. Appearance is a major factor in the judgment of quality and human eye has historically done this. The color indicates parameters like ripeness, defects, damage etc. The quality decisions vary among the graders and often inconsistent. The adaptation of human eye to small changes in color and the effect of the background on the perceived color and color intensity are the main sources of error. There are many efforts is being made to establish the standard quality parameters for fresh produce and the instrumentations that meet these expectation. Employing non-destructive sensing techniques in fruits industry assure the quality and wholesomeness of fruit. This would increase consumer satisfaction and acceptance, and enhancing industry competitiveness and profitability. Various non-destructive sensing techniques have been studied and implemented for predicting internal/external quality of fresh fruits.

Computer vision techniques have been shown to closely correlate with those from the visual assessment. Fruit size is one of the most important quality parameter analysis by consumer performance .i.e. consumer prefer fruits of equal weight uniform size for example people like yellow bananas, dark red apples, light green or dark black grapes, dark yellow loquat and yellow mango etc. The estimation mean of fruit size is important in meeting quality standard increasing marketing value monitoring growth. Fruit size estimation is also helpful in packing planning, transportation and marketing operation.

2. SYSTEM ARCHITECTURE:

I. System Block Diagram:

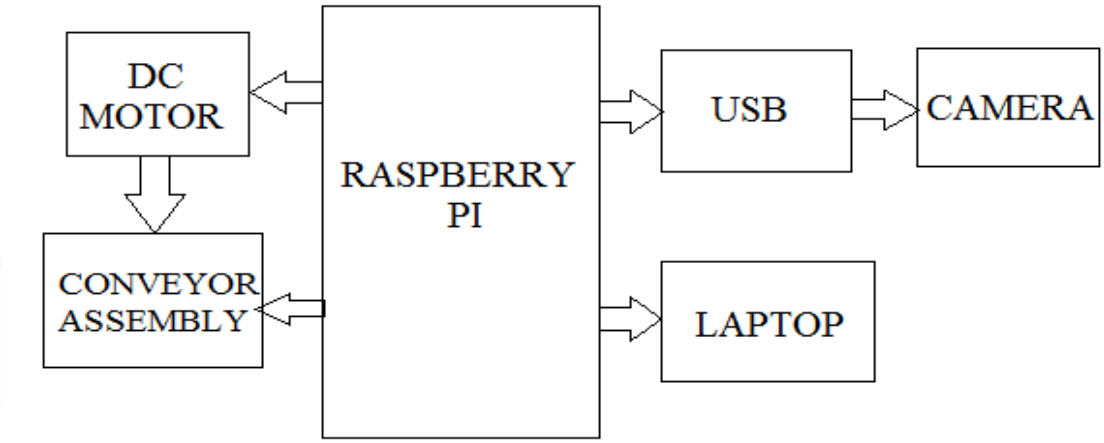

Figure 1: Block diagram

Building the block diagram for an idea is necessary part in order to examine the overall operations of the defined solutions. In this it describes image as an input and dc motor, conveyor and laptop as an output. The above figure 1 shows the block diagram of the project. This automated system is designed to overcome the problems of grading the fruit. Here the hardware model is designed which contains conveyor system, grading assembly which contains glass plates to which DC motor is connected, digital camera, Raspberry pi microcontroller, display unit on field and grading assembly. The scopes of objective are to develop a complete system to undergo color detection before quality analysis and grading of the fruits by digital image. The whole system will be undergoes real time analysis as possible submission.

II. RASPBERRY PI:

We propose a system which has a conveyor belt made up of glass run with the help of dc motor. Selecting and deselecting process of fruits can be made easier with the use of raspberry pi which is more efficient, cost effective and easier. Raspberry pi is a low cost, portable, multipurpose and tiny computer. The latest version of Raspberry pi is used in this system. The Figure 1 shows Raspberry pi interfaced with web camera, dc motor and linear actuator. A 5V and 2A power supply is given to the Raspberry pi to work. Python language is used for the programming which is very easy in raspberry pi. There are two webcams used in this project to capture the bottom and top view of the fruit. The camera interfacing with the raspberry pi does not need any additional programming.

III. IMAGE PROCESSING

The image could be captured using a regular digital camera. Here we have used for capturing image the webcam. The system arrangement is done as shown below the basic aim is to obtaining the fruit's features. The system consists of several steps like mask, image contouring and grading. As proposed in [1], to avoid shadow, two annular lights are used to supply well- distributed light. The white background color in image is easier to extract the fruit edge characters later. So the background is set black in whole process of image capture. The light and camera location is as shown in Figure 2.

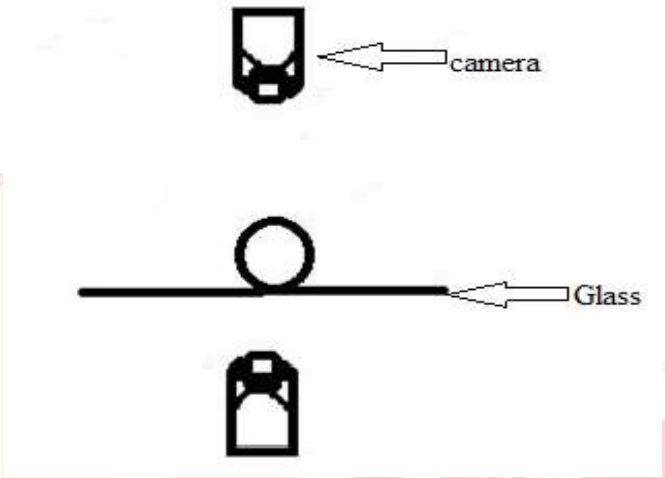

Figure 2: Conveyor

IV. Process Flow:

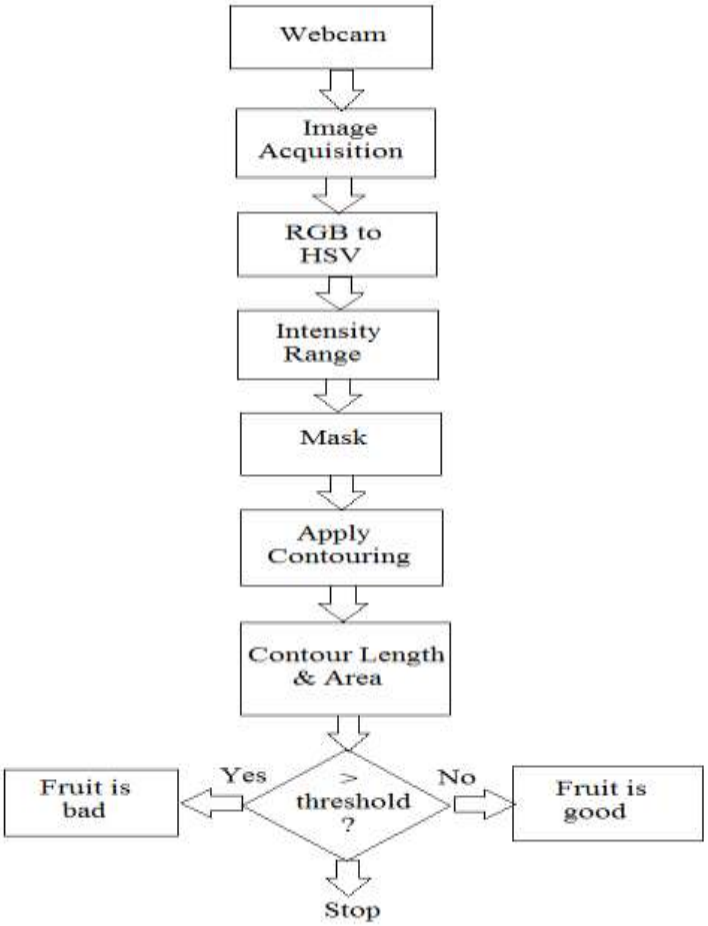

Figure 3: Flow Chart

Above figure shows the process flow for fruit detection. Fruit detection involves following steps:

1. Camera is placed at the top and the bottom of glass conveyor. Camera takes the picture of fruit when keyboard button " c " is pressed.
2. After capturing the picture image acquisition takes place. Image acquisition is nothing but converting an image in suitable form.
3. RGB to HSV: RGB color space describes colors in terms of the amount of red, green and blue present. HSV color space describe colors in terms of the Hue, Saturation, and Value. The HSV model describes colors similarly to how the human eye tends to perceive colors. In our project we need to identify black spots on the fruit therefore RGB to HSV conversion is needed.
4. Intensity Range: after converting the image in HSV color intensity ranges are defined.
5. Mask: In mask it shows where the black spots are on the fruit.
6. Apply contouring: contour tracking is a technique that is applied to digital images in order to extract their boundary. Here the boundary of black spot is exacted.
7. Contour length and area: after extracting the back spot their length and area are to be measured.
8. Threshold: If the contour area is greater than threshold the fruit is bad and the conveyor tilled to right side. If the contour area is less than threshold the fruit is good and the conveyor tilled to left side.

3. RESULT

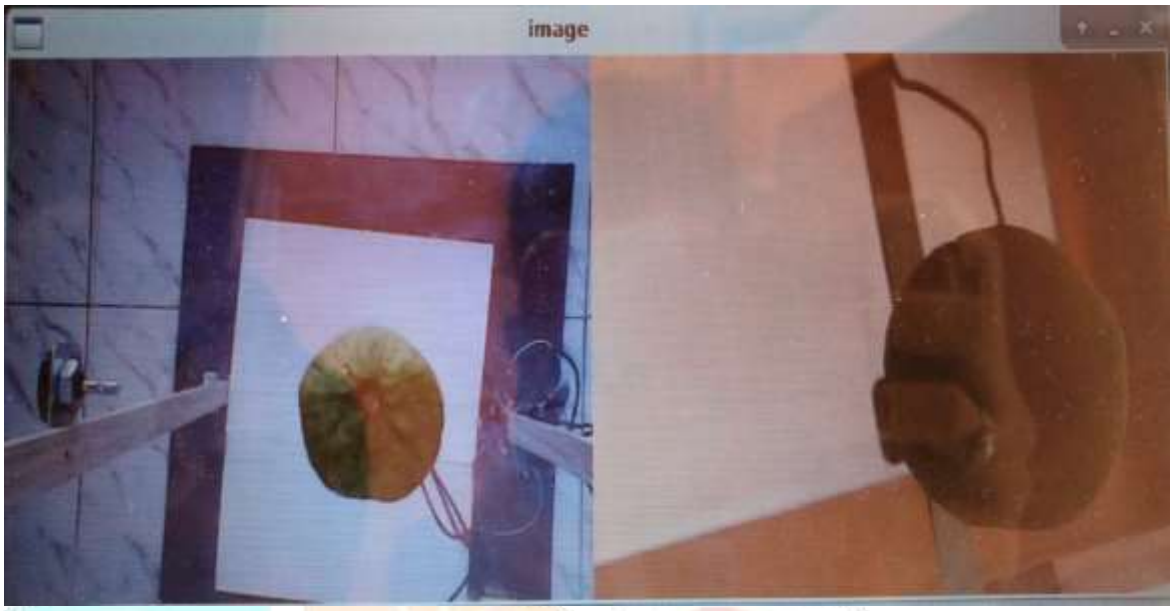

Figure 4: Top and bottom view of fruit captured by camera

Above figure shows the top and bottom view of fruit captured by two cameras. After capturing the image it analyze whether the fruit is good or bad.

4. CONCLUSION

The initiated system is a demo version. In future, for the great volume of production the number of web cameras and length of conveyor system can be changed according to our needs. This paper presents new integrated techniques for sorting and grading of different fruits. Generally image capture is a big challenge as there is a chance of high uncertainty due to the external lighting conditions, so the advantage of gray scale image is taken into account, which are less effected to the external environment changes as well as beneficial for finding the size of a fruit.

5. REFERENCES

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