Colour based Quality Analysis of Fruits for Automatic Grading using Raspberry PI

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Abstract: Non destructive 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 colours and size, which increases accuracy for detection of fruits pixels. Histogram of Oriented Gradients (HOG) is used for background removal, for colour classification Support Vector Machine (SVM) is used. The main idea behind the histogram of oriented gradient is that the local appearance and shape of object in an image can be described by the intensity distribution of gradients or direction of the contours. 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 RAPBERRY PI ultra low power microcontroller.

Keywords: RASPBERRY PI, IMAGE PROCESSING, Conveyor setup, IR sensor.

1. INTRODUCTION

In order to improve the fruits' quality and production efficiency, to reduce labour intensity, it is necessary to research non destructive automatic detection technology. Fruit non destructive 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, colour 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 colour 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 colour and the effect of the background on the perceived colour and colour 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. LITERATURE REVIEW

Hongshe Dang, Jinguo Song, Qin Guo [1] has proposed fruit size detecting and grading system based on image processing. The system takes raspberry pi as main processor and develops the fruits size detecting program using image processing algorithms on the QT/Embedded platform. Authors in [2] have proposed system which finds size of different fruits and accordingly different fruits can be sorted using fuzzy logic, here author proposed MATLAB for the features extraction and for making GUI. John B. Njoroge. Kazunori Ninomiya. Naoshiondo and Hideki Toita [3] have developed an automated grading system using image processing where the focus is on the fruit's internal and external defects. The system consists of six CCD cameras. Two cameras are mounted on the top, two on the right and another two cameras mounted on the left of the fruit. X-ray imaging is used for inspecting the biological defects. Image

processing is used to analyze the fruit's features; size, color, shape and the grade is determined based on the features. The developed system is built from a combination of advanced designs, expert fabrications and automatic mechanical control.

3. SYSTEM ARCHITECTURE
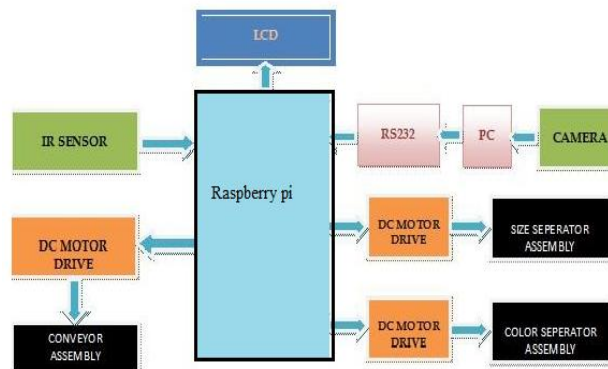
I.   System Block Diagram:

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 and size (IR) as an input and dc motor, conveyor and display unit as an output. The above figure 1 shows the block of the project. This automated system is designed to overcome the problems of manual techniques. Here the hardware model is designed which contains conveyor system, grading assembly which contains three plates to which DC motor is connected, digital camera, IR sensor, Raspberry pi microcontroller, LCD display 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 run with the help of dc motor and corresponding pulleys at the motor and its opposite ends which constantly run with the help of raspberry pi. 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 it is Raspberry pi which 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.

III.   IMAGE PROCESSING

The image could be captured using a regular digital camera. Here we have used for capturing image the iball twist cam which is CMOS based camera. 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 feature extraction, sorting and grading. As proposed in [1], to avoid shadow, two annular lights are used to supply well- distributed light. The black 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.
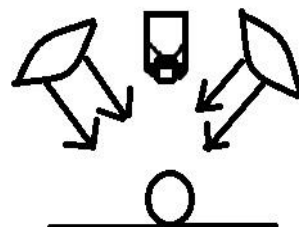

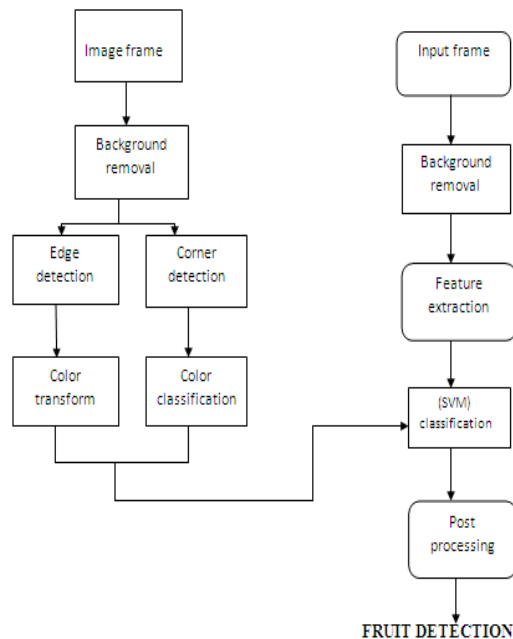Figure 2: Conveyor

IV. PROCESS FLOW

Figure 3: Flow Chart

The process of fruit quality monitoring is as follows

- Color detection
- Edge detection
- Color grading
- Fruit grading

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.

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