

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 2, February 2018

A Review on Quality Determination and Grading of Tomatoes

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ABSTRACT: Nowadays the food quality is become a major issue as it directly affects health. For satisfaction of a customer desire, it is very important to have good quality of fruits. But in bulk it is very difficult to sort out good quality fruits. In this system considered tomatoes as fruits having different shape, size, colour and texture for finding quality and grading. Parameters that are consider for grading of fruits are shape, size, colour and texture, which vary from one product to another. Different types of algorithms are available to extract feature of fruit characters by capturing the fruit image. This work aimed to study different types of algorithms used for quality grading and sorting of fruit from the acquire image. In previous years several types of techniques are applied to analyse the good quality fruits. In this paper, such food quality and fruits grading techniques are reviewed.

KEYWORDS: Raspberry Pi 3, conveyor system, D.C. Motors, Camera, Image Acquisition, Contour.

I. INTRODUCTION

In general, the harvesting process is done on fruit such as tomatoes before they fully ripen. Decide the quality of tomato on shape, size, colour and texture grading by human eyes often leads to error due to visual stress is not accurate. A vision machine to replace human eyes can solve this weakness since a machine will not prompt errors due to stress. Human vision has limited ability in differentiating similar colors like pure green (100% green) with orange (90% orange), light red (60-90% red) with red color (>90% red). Human perception towards shape, size, colour and texture is subjective and varies among different peoples. A same fruit may appear as light green for first human but pure green for second human. This leads to inaccuracy of the judgment for tomato maturity. Color grading is a main step in this system design for processing of fruits that directly affects profit, because the products quality is mainly associated with their color. The existing color grading systems use a set of color separating parameters to determine the color quality. In this Project 100% Red, 100% Orange color tomatoes is fully mature and ready to consume and 100% Green, 50% Green color tomatoes is premature and ready to transport. The proposed automated classification and grading system is designed to combine five processes such as Image Acquisition, Masking, Contour, Image Enhancement, Color Detection. The entire system is designed over RASPBERRY PI software to inspect the shape, size, colour and texture of the fruit. Here grading can be categories into four ways Red, Orange, Green, turning to Green. Work in this paper considered tomatoes as fruits having different shape, size, colour and texture for finding quality and grading. In this paper simple and effective method will be used for evaluating maturity level of tomatoes.

II. LITERATURE SURVEY

Monika Jhuria, Ashwani Kumar, Rushikesh Borse [1] proposed image processing for smart Farming detection of disease and fruit grading. artificial neural network is used developed algorithms and they can be successfully detect and classify the tested disease and get better result for color and morphology they reported 90% result as compared to texture. And also he developed mango grading system depending on weight using mathematical formula weight of mango calculated classify in to 5 different grades. Suresha M. Shilpa N.A Soumya B [2] proposed effective automatic Grading system of apple based on SVM Classifier. The database contains 90 images. The proposed method efficiently

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classifies apples as red apple and green apple. For these RGB images of apple is converted into HSV image and used threshold based segmentation to segment the apple image from the background. Average red and green color components of the apples are determined for classification of apples. By using linear kernel function for the SVM classifier they reported 100% accuracy. Chandra shekhar Nandi[3] implemented a computer vision based system for automatic grading and sorting of mangoes based on maturity level from its RGB image frame, collected with the help of CCD camera. Parameters of different classes of mangoes are estimated using Gaussian Mixture Model. Graph contour tracking method based on chain code is adapted for finding the boundary of the mango. This automated technique is good but is further affected by ambient light intensity. Response time of system is on the order of 50 ms. Harshavardhan G. Naganur, Sanjeev S. Sannakki, Vijay SRajpurohit, Arunkumar R[4] 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.

Hongshe Dang, Jinguo Song, Qin Guo[5] have proposed fruit size detecting and grading system based on image processing. The system takes ARM9 as main processor and develops the fruits size detecting program using image processing algorithms on the QT/Embedded platform. Wong Bing Yit, NurBadariah Ahmad Mustafa, ZaipatimahAli, Syed Khaleel Ahmed, ZainulAbidinMdShariff[6] proposed new MMS-based system design and developed with signal processing for fruit grading for consumers. The prototype network architecture, integration of wireless messaging system with signal processing between mobile consumers for development purposes was studied, proposed and designed. John B. Njoroge, Kazunori Ninomiya, Naoshi Kondo andHidekiToita[7] 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. J. V. Frances, J. Calpe, E. Soria, M. Martinez, A. Rosado, A.J.Serrano, J. Calleja, M. Diaz[8] presented a procedure to improve the performance, whether increasing speed or accuracy of the load-cell-based weighting subsystem in a fruit sorting and grading machine to achieve an accuracy of + lgram.

III. THE SYSTEM OVERVIEW

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 plates to which D.C. motor is connected, digital camera, LCD display on field and grading assembly, The block diagram of a system is shown in Figure,

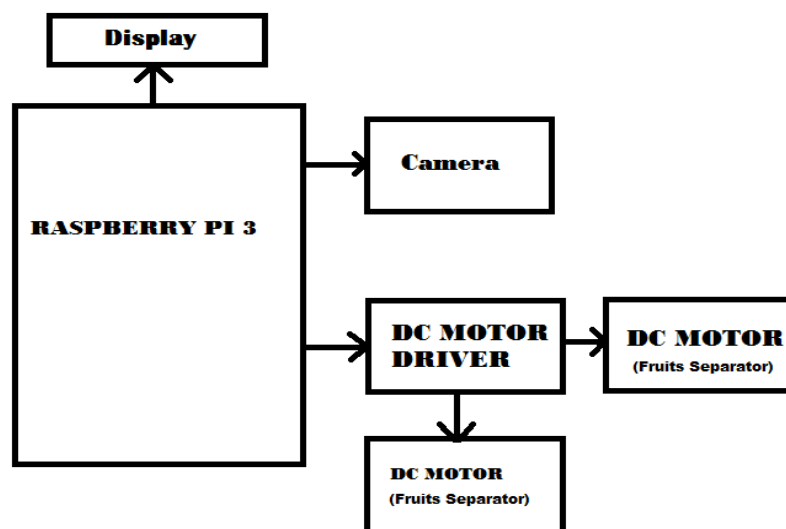


Figure: Block diagram of Quality determination and grading of Fruits system.

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The image could be captured using a regular digital camera. The system consists of several steps like feature extraction, sorting and grading. For grading using first choice camera position is adjusted in such a way that for capturing live image of a fruit the camera is continuously scanning the conveyor belt in video mode. The captured image is given as an input to the RASPBERRY PI software which extracts (detects) color, shape, size and texture of a fruit.

IV. PROPOSED METHODOLOGY

The Proposed Work in this paper considered five different methods for quality determination and grading fruits. Tomatoes having a different features like color is red, green and orange, also having different size and texture. For sort and grade the good quality fruits according to different attributes such as color, shape, size and texture use specific methods. It mainly contains five methods the system overview. The five methods will be introduced as follows.

A. Image Acquisition

Image Acquisition is the first step in this system. In this process tomatoes images are captured by three cameras setting an angle 120 degree each. Tomato is on place on glass transparency sheet for capturing both side images. Real-time image acquisition creates a stream of files that can be automatically process. Tomato images were taken as a sample data for training purpose which is in the dimension range from 640x480.

B. Masking

Masking is a filtering. It consists of moving the filter mask from point to point in an image. For blur image, it make pixel intensities as smooth as possible. Masking is separating an image from its background and place the image over another background. Pixels are geometrically adjusted to match the desired map projection. For increase sharpness of an image masking is use.

C. Contour

The contour is known as border following or boundary following. It applied to digital images in order to extract their boundary. Contour performed on digital images to extract the general shape of images. It will detected the wanted shape from the images of tomatoes and also examined different characteristics of images.

D. Image Enhancement

The purpose of image enhancement is to highlight certain features of interest in an image. Enhancement is the modification of an image to alter impact on the viewer and distorts the original digital values. Enhancement is not done until the restoration processes are completed.

E. Color Detection

In the process of fruit color is detected according to RGB values, here fruits are sorted according to color and size. A digital camera is used to capture tomato images and then transferred to the computer. These tomato images are cropped to a size of 640X480 pixels with the white background. Transfer input to raspberry pi and it is used to classify the grades of tomato.

V. CONCLUSION

Several process is use for determining good quality and grading of tomatoes. It had 4 level of grading (Red, Orange, Green and Turning to Green) with some images of tomato. In this paper, we have done the comparison between different method uses by different authors and studied various algorithm in different ways for finding a good quality of tomatoes. The proposed system is a demo version, so for a large scale production the number of cameras and length of conveyor system can be modified. This work presents new integrated techniques for sorting and grading of different fruits. The proposed method can process, analyze and recognize the tomato based on shape, size, color and

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texture feature. In order to improve the functionality and flexibility of the recognition system hardness, softness features can be combined together with shape, size, color and texture feature.

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