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Cashew Grading Using Image Processing

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Abstract*— The food quality that we consume is of more importance, as people are becoming educated their demand for quality of grains is increasing. There is possibility of adulteration of food grains by the traders. Generally, the quality assessment is carried by visual inspection which is manual process. In this work an image processing technique with Raspberry-pi is used as an attempt to automate the process which overcomes the drawbacks of manual process. This project provides the quality assessment of cashew nuts based on its size. Based on the size the cashew is graded as (grade 1, grade 2 and grade3. The system is developed using multiple images and are classified using decision tree-based classification technique. The results are found to be encouraging.*

Keywords— Digital Image Processing, Raspberry-pi3, Python Language.

1. Introduction

The dry fruit processing industry in India is growing at the rate of 4% per annum while cashew nut consumption growth in India is about 3% per year. India is a leading exporter of cashew is also growing with innovative products being introduced in snack foods, bakery items and sweets.

Manually experts have the naked eye observations that are the main approach used in practice for gradation and identification of cashew nuts defects. But, this requires continuous monitoring and management of experts which might be prohibitively increases the expensive in large farms. Further, in many developing countries like India, farmers may have to go long distances to contact experts, this makes advisory experts too expensive and time consuming and moreover farmers are unaware of non-native defects.

In order to improve the cashew nut's quality and production efficiency and to reduce labor power, it is necessary to research nondestructive automatic detection technology. Evaluation of cashew nuts is the process of detecting fruits' quality . Now-a-days, the excellence of cashew nuts size(major axis and minor axis) cannot evaluate on line by using traditional methods. With the development of image processing technology and computer software, it becomes more efficient to detect cashew nuts' quality by using Raspberry-Pi.

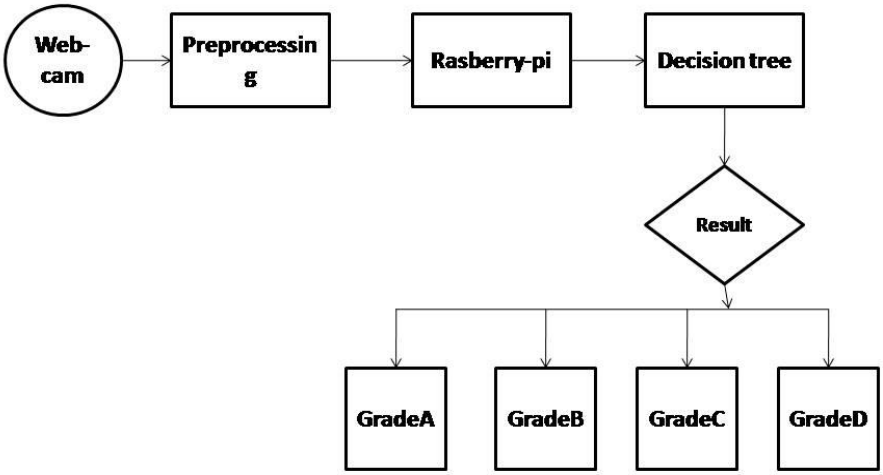
Image processing is used to analyze the fruit's features; size, colour ,shape and the grade is determined based on the features. The real time system is built from a combination of advances designs, expert fabrications and automatic mechanical control. At present, most existing cashew nuts quality detecting and grading system have the disadvantage of low efficiency, low speed of grading, high cost and complexity. So it is very important to develop a high speed and low cost cashew nuts size detecting and grading. Appearances are a major factor in the judgment of quality and human eye has historically done this. The main aim is to build the machine which can be used as a grader and separator so the work can be done automatically.

2. Literature Survey

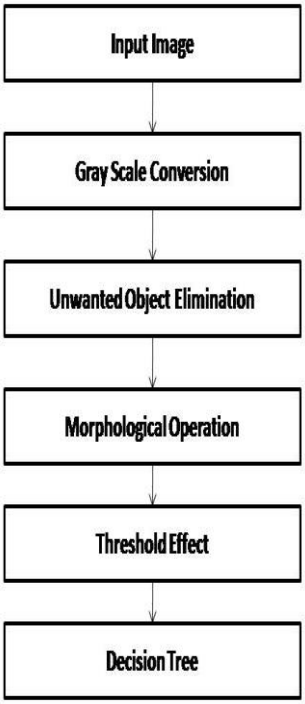
1) A real-time prototypical date grading and sorting system was designed by Ohali [1], in which different external features such as color, size, shape and defects were extracted from the images to feed to the classifier for the grading purpose.
2) Razmjooya et al [2] developed a realtime system for sorting potatoes according to their size and to identify defective potatoes based on their color. In order to determine the size, maximum diameter, minimum diameter and Length/width diameter ratio was calculated. To recognize the defects of potatoes, colour features were used.
3) Szczypinskiet al [3] performed a detailed study on the identification of barley varieties, in which morphological features, statistical texture features and color component histograms were used to extract shape, texture and color features respectively.
4) Araújoet al [4] proposed a method for Beans quality inspection using correlation-based granulometry. In granulometry, the captured image was compared with kernels that represent all the shapes , eccentricities, orientations and sizes of the grains and the correlation was computed. To filter out the false detections, the peaks with low correlation and peaks that have large intersections with other peaks are discarded. Cross correlation was efficiently computed using FFT (Fast Fourier Transform).

Huang [5] developed a method for determining the quality of areca nuts using machine vision based on color and texture features

3. System Design:



3.A. Preprocessing Block Diagram:



3.B. Working:

In our system, the Image processing is divided into three sections. In the first section, it carries out some preprocessing in the whole input image including gray scale conversion, threshold effect and noisy object elimination.
In the next section, the cashew is extracted from the whole image and in the last one, defect detection and identification method is applied.

In section one, firstly the RGB image is converted to a gray scale image and then threshold effect is applied with some value. The resultant image may contain some noisy objects which can create erroneous results. To minimize their effect, these unwanted objects are eliminated according to their sizes. In second section a cashew is extracted from the image. Then these two images are subtracted and this resultant image will be the fault on pipe. Again the image resulted contain some noisy elements. So to reduce their effect, these unwanted object elimination is done according to their sizes. Finally some fundamental features i.e. size, aspect ratio, texture are calculated for each cashew.
This image processing includes the capturing the image ,noise removation , rgbtogray conversion, unwanted object elimination, threshold calculation and on the basis of decision tree cashew is graded and separated.

3.C Pre-Processing:

The raw data (RGB image) acquired from digital camera are pre-processed for further data analysis. It includes image acquisition, the gray scale conversion, morphological operation, threshold effect and elimination of noisy objects which are present in the raw image. The different data-processing stages are described below.

Input image is acquired from digital camera and then it is converted into gray scale image.

After Gray scale conversion threshold effect is applied with some value. It converts Gray Scale Image into Binary Image.

After threshold effect some noise is generated in image. Some unwanted objects (some dots, some small objects and noises) remain in the image.

3.D. Extraction of Cashew:

After unwanted noise elimination, the separation of pipe from image is performed or only pipe image is generate by filling the region by selecting points interactively.

1. Cashew Detection and Identification:

By performing mathematical operations, the two image i.e. image with fault and only cashew image are subtracted and resultant image will have the only faults that are on the pipe. This is how the fault is detected.

Again this image contains some unwanted objects (some dots, some small objects and noises) in the image. So, by removing these small objects from binary image fault is detected.

Before detecting the defects, morphological morphology is applied on image. Dilation and erosion methods are performed to connect the disjoint lines. Then by calculating the area and eccentricity, defects are classified into hole and crack. After this by calculating no. of pixels of defect, the defect is classified into major defect or minor defect.
According to the grading cashews are flipped using conveyor belt.

4. REQUIREMENTS

1. HARDWARE USED:

   a) RASPberry-Pi

   b) Camera

   c) Stepper Motor

   d) DC MOTOR
   {

Speed	: 100 RPM
Diameter	: 37 mm
Input Voltage	: 4 V to 12 V
Torque	: 28 kg-cm
Shaft Diameter	: 6 mm
Shaft Length	: 22 mm

   }

2. SOFTWARE USED:

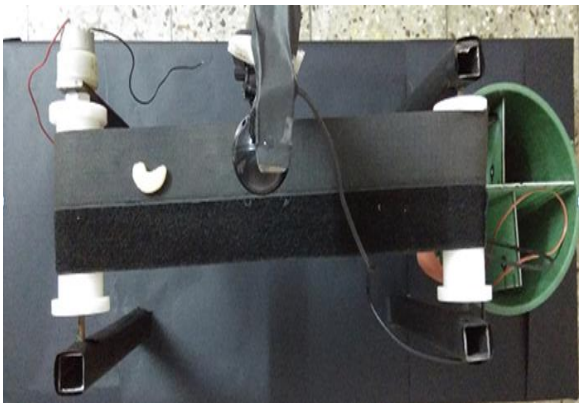
   OPEN-CV

5. Algorithm:

1. Start
2. Initialize the System on Pi system.
3. Start the Conveyor .
4. Take the Snapshot of cashew.
5. Give the Image to memory
6. Perform Image Preprocessing
7. Perform Threshold operation
8. Find the Category of cashew.
9. Show the result
10. Actuate the Mechanism according to Result
11. If Filler empty then stop
12. Or go to the Step to 3

6. Experimental Result:

There will be four outlets the output of which will be good and bad quality cashews, the good cashews will be further divided into 3 grades. After every completed process the owner will get notification.



5. Future Scope:

When we used this system on real time basis for large scale we can use Robotic flipper.so that the cashew can be saperated in no time.

6. Conclusion

Using most relevant features one can significantly improved automation of cashew grading process. In our system cashew kernels are placed on the one side of the conveyer belt which will move forward .once reached below the webcam ,image is captured get preprocessed followed with training database ,on the basis of decision tree the grade of the cashew is displayed on the monitor and accordingly it get separated and move to the desired container. Thus we get grade wise separated cashew. Increasing the database will result in more accuracy.

7. References

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