

Sorting of raisins using computer vision approach

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Abstract - In this research, an apparatus for sorting raisins has been designed and fabricated based on computer vision approach. This system was composed of conveyor belt, lighting box, controlling and processing system unit. Color feature is the most important parameter in classification and sorting of raisins. In order to carry out image processing and to extract useful features of captured images by computer vision a highly efficient algorithm was developed and implemented in MATLAB as well as Python environment. The algorithm was consisted of background segmentation, raisin selection and feature extraction. The developed algorithm initially extracts the raisins by removing the background from the taken images. It then sorts the raisins according to their RGB color. The final step in the algorithm was making ON and OFF the sorting mechanism used for automatic sorting. The system can be easily adapted for sorting other agricultural products such as cashew and almond.

Key Words: Raisin sorting, Color image segmentation, Computer Vision, Feature Extraction

1. INTRODUCTION

The ability to sort agricultural produce automatically is more efficient compared to the manual inspection which is slow, labour intensive, tedious and error prone. However, automatic sorting of agri-produce requires an intelligent system that can identify the agri-produce based on its characteristics.

Our research focuses on the development of a software package and hardware based on the identification of features for agri-produce.

In development of Indian economy Agriculture plays a major role. Production of raisins is in large scale, in fast growing countries like India. Manual procedures or some machinery based on size sieves are used for Sorting of raisins for the export and internal usage. These machines used are very costly and are equal to a size of room. These machineries are called sorter machines. Sorter machines are different for different fruits and grains based on their sizes. Farmers feel it better for hand picking of fruits. Manual sorting is laborious, tedious, time consuming and

inaccurate. The poor classification and sorting will lead to reduction in quality assurance.

Due to these drawbacks of manual sorting an automated sorting system needs to be developed which is affordable by small traders and farmers. Automatic sorting system increases production and also reduces the dependency on manpower. The manual sorting and sorting has been replaced by computer vision system which has many advantages like high accuracy, uniformity and processing speed. Sorting of agricultural products is done to identify the quality of the product and to separate the good quality from poor. Raisins are graded to get the best quality according to industry standard. Automated system uses different types of algorithms to extract features of the fruits and technologies for classification of the fruits. Automatic sorting system is adopted in order to overcome the problems of manual sorting.

Digital Image Processing techniques were utilized for feature extraction from an image. In this we are using image processing toolbox in MATLAB and the same is done by using Python. So, instead of human vision, computer vision system is used.

The author [2] and [4] developed such sorting machines but that machines are having high cost and the algorithm used is very complex.

So, the objective of this paper was to design an automatic sorting machine and an efficient algorithm for sorting of raisin based on computer vision at low cost.

The developed system mainly consists of three major parts, namely Conveyor system, imaging system and sorting system.

2. Types of Raisin

India produces raisins in bulk. There are many grades and types in raisins. They differ with color shape and size. The types given below are the industry standard grades. The following are Varieties of raisins available and their characteristics.

2.1 Green Raisin

- Usually green in colour.
- Long and round shaped berries.
- These are prepared through dipping in oil and dried in shades to get the peculiar colour and taste.
- These are similar to Chinese and Afghan variety.
- Mainly used as a table premium variety

2.2 Golden raisin

- Usually golden in colour and some are bright sunshine gold in colour.
- Long and round shaped berries.
- These are prepared by dipping in oil and dried in shade to get the colour and taste. Some are
- Prepared by treating in sulphur and dried in racks.
- These are used as table variety, food additive and high value food industry.
- These are similar to Iranian golden raisins.

2.3 Brown raisins

- These are brown and dark brown in colour.
- These are prepared through dipping in oil and drying in shade some are directly dried in sunlight.
- These are used in bakery, confectionery, ice-cream, medicinal and other culinary products.
- These are similar to American Thomson seedless raisins.

2.4 Black raisins

- These are black in colour made from black grapes.
- These are long and round in shape.
- These are prepared by dipping in oil and dried in shade to get the colour and taste.



Fig-1: Types of raisin

3. Proposed System

The step-by-step procedure as shown below:

3.1 Image acquisition:

Firstly, the RGB color images are captured using a digital camera with required resolution for good quality. Here we have used raspberry pi camera as well as some other cameras like mobile camera and USB camera. By using any one camera from above mentioned cameras we are getting near about same results.

3.2 Image Pre-processing:

In pre-processing we are thresholding the captured image to detect the raisins by removing the background.

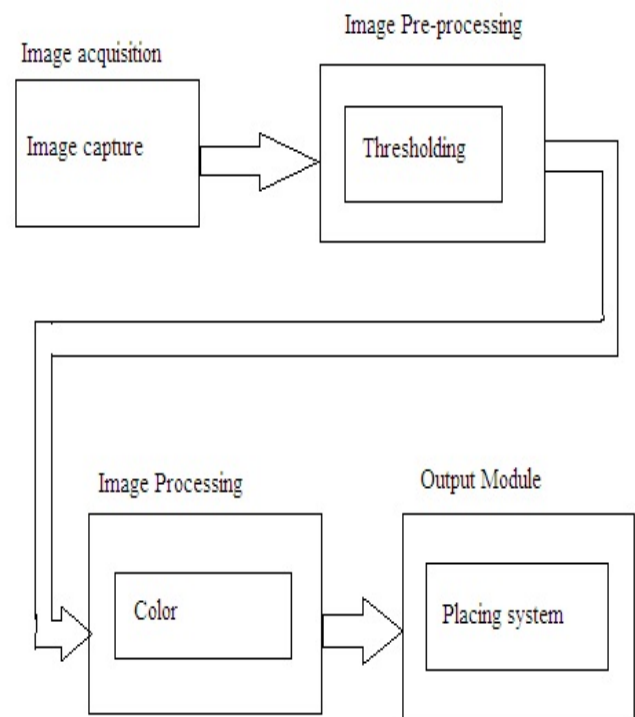


Fig-2: System Architecture

3.3 Image processing:

After image preprocessing some morphological operations we have performed. Once raisins are clearly detected they are labeled and after that mean color of that raisin is given to that raisins particular label. And we are getting average colored image. From that by using specific RGB values of raisin which we want separately from other are used for sorting. The overall flow from image capturing to feature extraction is as shown in fig [3].

3.4 Output module:

The classified data after image processing is given to the output hardware which will further process that data to activate the linear actuators for sorting of raisins.

4. Mechanical Assembly and Working

Our main objective was to develop a sorting machine with LOW cost. And to achieve the speed of existing sorting machine we require a high resolution camera. But these cameras are having very high cost. Also the mechanism used for such sorting machine is complex and costly. Because it requires one air compressor also. So because of this we designed a new mechanism to flow raisins from the front of the camera. The complete mechanical assembly is shown in fig [4] and [5].

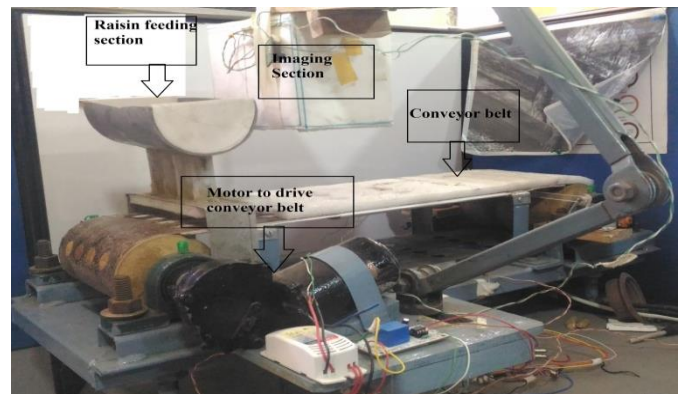


Fig-4: Side View of Conveyor belt and other Mechanical Assembly

4.1 Raisin Feeding Section:

The first thing that all should know here is we have not considered the size of raisins. We have taken all the raisins of same size. So we are putting bulk of raisins from raisin feeding section. From this section at a time only four raisins are placed in the holes of conveyor belt. Here we are using 10mm thick conveyor belt.

4.2 Raisin imaging section:

As raisin starts moving on conveyor belt, they are captured by camera at imaging section. At a time only a single row of four raisins is captured. The captured image is then processed to distinguish the color of each raisin. The image processing flow is as shown in fig [3].

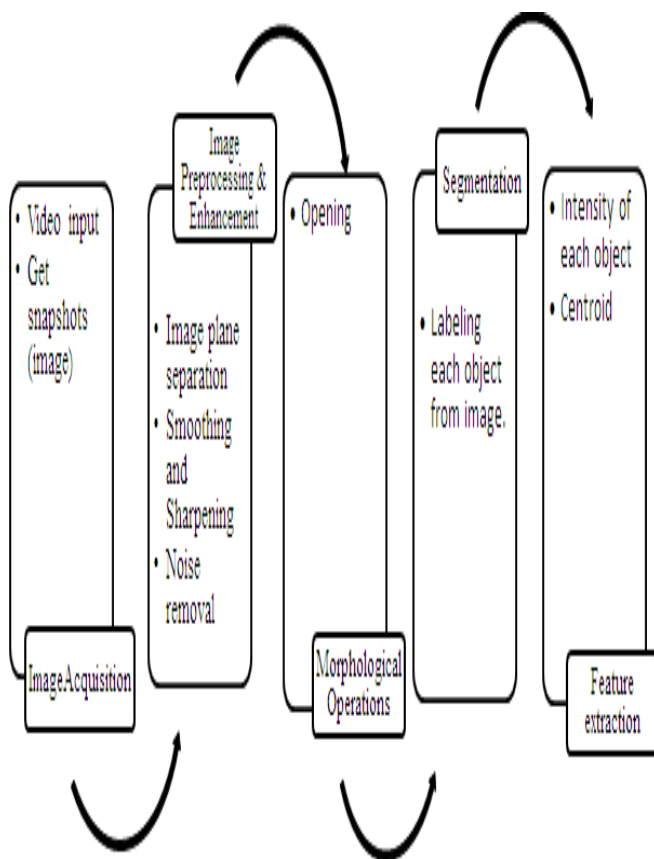


Fig-3: Image Processing Flow

The mechanical assembly of the system consists of mainly four sections: 1) Raisin feeding section, 2) Raisin imaging section and 3) Raisin sorting section.

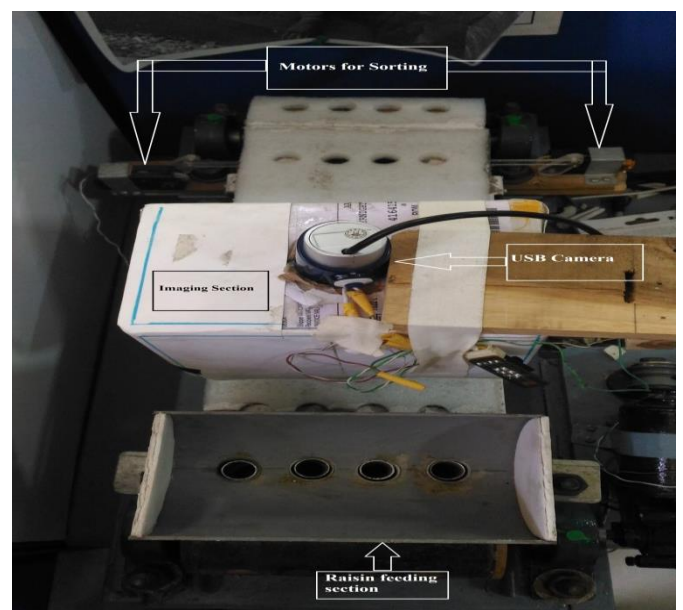


Fig-5: Top View of Conveyor belt and other Mechanical Assembly

4.3 Raisin Sorting Section:

In this section we have used small opening and closing exit doors below the four holes of conveyor belt and that are controlled by small dc motors. That is the raisin moving on conveyor belt is dropped down from the hole at this stage if door is open. Depending on color of raisin these doors are controlled at image processing stage. That is the door will be closed as it is or will it open should be decided immediately after image processing in the same code.

5. Results:

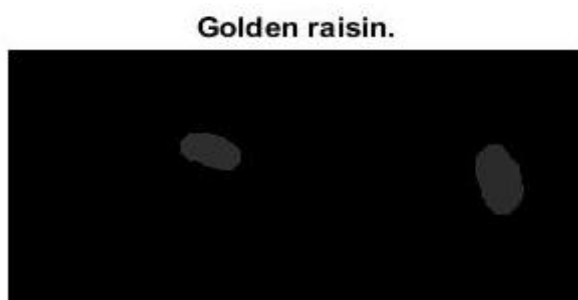
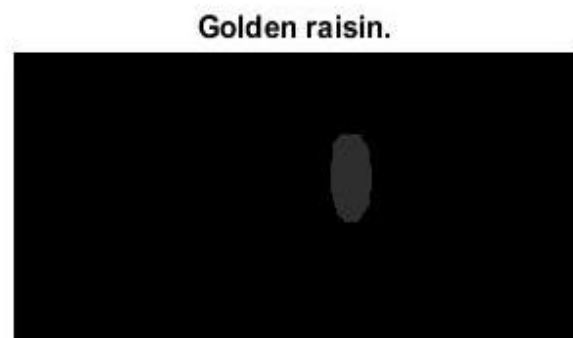


Fig-7: Output after Image Processing [2]

Fig-6: Output after Image Processing [1]

Here we separated golden raisin from mixture of all type of raisins. Other color also we can separate out by changing the color threshold.

6. Conclusions:

Hence, without help of DSP processor the user friendly raisin sorting system for domestic/industrial control has developed using the concepts of Image Processing and Robotics Mechanism.

We conclude that for fast manipulation the algorithm implemented in MATLAB as well as in Python is suitable for sorting of raisins and also for some other products. Here we are getting less speed as that of big sorting machines used in industries but it can be improved by using high definition camera and high speed sorting mechanism.

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