

Microcontroller Based Fruit Sorting Using Image Processing In Matlab

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Abstract: The objective of this system is to do automatic fruit sorting. For fruit sorting the fruit colour ratio which is calculated by RGB colour model which is used for classification feature. For evaluating the quality of fruit, image processing using MATLAB software is used than the sorting part is done by the microcontroller and motor. The purpose of using automation is to evaluating the quality of fruit using traditional method which can bring human error so to minimize it this system is being designed.

Keywords: Camera, Conveyor Belt, Image processing RGB Model, MATLAB, Microcontroller, Sensor.

I. Introduction

It is difficult in industry to classify the quality of fruits using traditional method so the image processing technique was introduced to classify the fruits. Image processing is used to convert an image into digital form and perform some operations on it, to get an enhanced image or to extract some useful information from it. In this the input is in the form of image captured from camera and output is some information extracted from the image^{[5][6]}.

In the proposed paper, we are using a fully automated system & it is designed such that it will classify and distribute fruit through a conveyor belt towards the dispatch section and it will check the fruit based on dimension and colour, if it is found good then conveyor belt will move continuous otherwise it will stop and the fruit will be passed to basket^{[4][2]}. To do so we are using microcontroller, conveyor belt, sensor & motor. As the signal is applied to conveyor belt through microcontroller it starts moving, then the sensor will detect the fruit & stops the conveyor belt. The camera clicks the image of fruits and checks the colour and dimension of fruits. If quality of fruit is good then it will command conveyor belt to move straight forward otherwise it will stop and sort the fruit.

II. Literature Survey

“ Fruit Quality Management & Sorting system “ by Madhura.R. Lodam, proposed the system based on GUI in MATLAB is used as a reference point to calculate size, height & weight on the basis of that the fruits are sorted. They are mainly focused on to increase the quality of food products and to check the quality with minimum amount of time and the GUI displays all the features and the fruits sorted^[1].

“ ARM Based Fruit Grading and Management System Using Image Processing “ by Manoj Avhad, proposed that the system has ARM as the main processor and it used to checks the quality of fruits based on fruits colour, size detection and grading system and has used GSM module for getting the idea of grading system to head office^[3].

“ A Fruit Quality Management System Based On Image Processing “ by Ms. Rupali. S. Jadhav, proposed that to investigate and control quality, embedded system is used to provide high accuracy of grading, consistent and quantitative information. They also used grey scale images to get proper images and to find size of a fruits^[2].

III. System Overview

The proposed system nullifies the human error which are generated in the traditional method and to give quality result at the output^{[4][8]}. To do so we have used Sensors, Camera, 2 DC motor for push mechanism and conveyor belt, Microcontroller with USB TTL cable and the MATLAB software. Fig 1.1 shows the block diagram of the system.

- I IR Sensor :- In this system we have used 1 IR sensor. Basically when the power supply is on, conveyor belt starts moving so when the fruits is kept on conveyor belt the IR sensor detects it and stops the conveyor belt near camera^{[1][3]}.
- II Camera :- The type of camera used in this system is USB camera. It captures the picture of the fruit and gives it to computer^{[1][11]}.
- III Conveyor belt :- The platform where fruits are placed is the conveyor belt which is controlled by IR sensor & Microcontroller^{[1][11][3]}.
- IV USB TTL Cable :- The USB TTL serial cable provides connection between USB port & serial UART interface. It is used for converting USB data signal to the standard serial data port and it is a two way data transmission^{[1][3][12]}.
- V DC motor :- Here is 12V DC motor is used to drive DC based conveyor. AC cannot is not capable enough to provide the required amount of current to the DC motor. SO DC motor driver L293D is used.
- VI Microcontroller :- The AT89C52 Microcontroller is used in this system. Based on the coding given to the microcontroller by MATLAB it detects fruit color and move the fruits in tray with the help of dc motor^{[4][8]}.
- VII Software :- The process of extracting the feature from an image captured with the camera can be done from MATLAB. In MATLAB the Graphics User Interchange (GUI) are used to sort fruits based on the combination of the Red, Green, Blue color on this we get to know quality of fruits is good or poor. The purpose of using MATLAB software it has inbuilt libraries and it gives accurate result^[10]. Fig 1.2 shows the flowchart of image processing

Color detection algorithm :-

Step 1:- Capture Image

Firstly the camera captures the image. The image captured is in the RGB format. In MATLAB each pixel is of 3 dimensional and is represented in the form of matrix whose size is equal to the size of image.

Step 2:- The colored image converting to Black and white image.

Before converting to Black and white image, the RGB colored image is converted to gray scale image. The gray scale image is a matrix which holds luminance value of image. The luminance coefficient are calculated based on the sensitivity.

$$Y = 0.3 * R + 0.59 * G + 0.11 * B$$

Than this gray scale image is converted to black and white image. The function in MATLAB that provides the conversion between grayscale to B/W image is $BW = \text{im2bw}(I, \text{threshold})$.

Step 3:- Recognizing the colour

In this centroid pixel of object is to detected and extracted firstly, to get the value of the pixel there is a MATLAB function $P = \text{impixel}(I, x, y)$ is used in this the I returns value of pixel in specified image, where x and y gives centroid value. In the 3D matrix of RGB colour space, if the value of specified centroid pixel has more amount of red colour than blue and green than the fruit would be considered as healthy. So depending on the proportion of RGB in the specified centroid pixel the fruit is sorted on good or bad. Fig 1.3 shows the processing of apple image in MATLAB.

IV. Figures

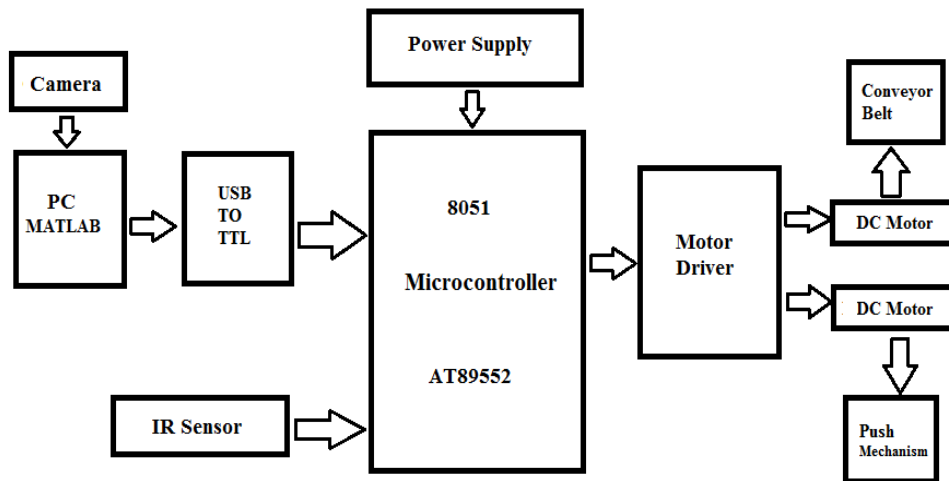


Fig 1.1: Block Diagram

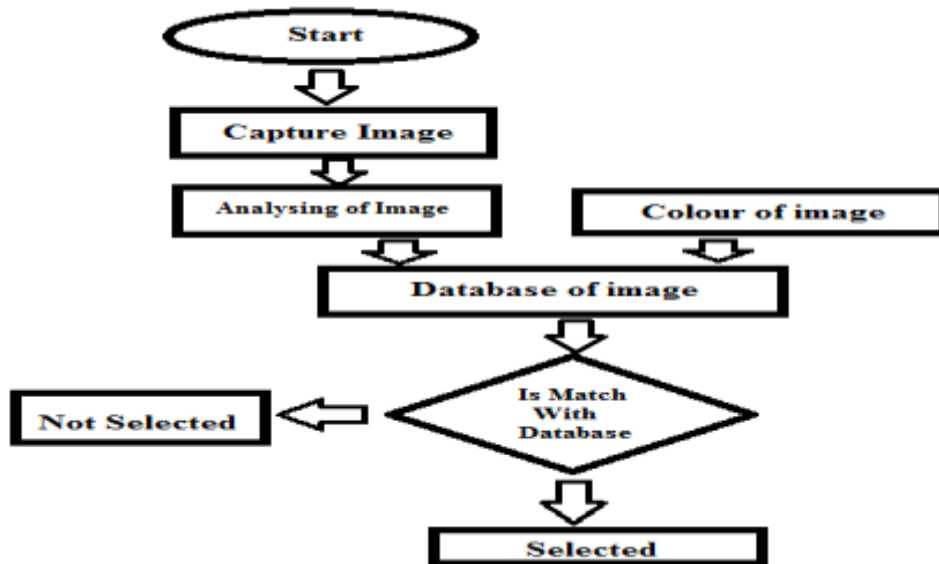


Fig 1.2: Flow Diagram^{[6][13]}

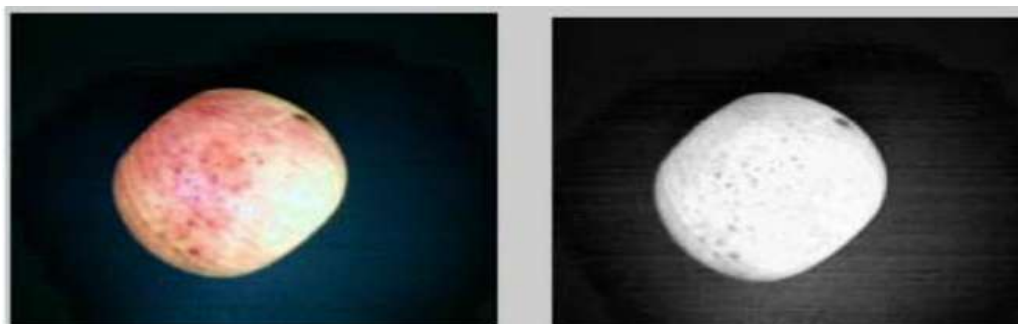


Fig 1.3: Processing of image^[2]

V. Conclusion

The image processing is done in MATLAB which is interface with a USB web cam on PC/ laptop which captures the image of the fruit. According to the command given by MATLAB to microcontroller sorting of fruit is done. We are using RGB color model for image processing so it will sort on the basis of three colour

RED, GREEN and BLUE combination. The whole sorting process takes approx 30 seconds to sort one fruit.

VI. Future SCOPE

- I The inner contents of the fruit could also be analyzed for exotic class fruits using x rays. In exotic fruits like peach the split ends of the peach could be detected using transmission images in real time to evaluate the water content distribution and internal structure of fruit.
- II Packaging services can also make use of this automation provided and distinguish between export quality and standard quality food products discretely at higher speed.
- III Shelf life of various food products can be estimated using the moisture sensor algorithm.
- IV Microwave Radar Technology can be implemented and smallest holes in food product can be detected.
- V For better accuracy we can also use open CV software instead of MATLAB as it has many inbuilt libraries and it uses python programming.

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