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## SORTING OF FRUITS BASED ON RIPENESS LEVEL,SWEETNESS AND ROTTENING

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## ABSTRACT

In this method, an image of fruits is firstly taken by web camera.then it will pass to pc through USB to serial converter cable.after image is recived it will save in matlab for processing .using image [processing the ripeness and rottening detection takes place.for sweetness we are using soil moisture sensor which is a non distructive method for sweetness detection.according to voltage sweetness value will be display on LCD display.according to the detection value the sorting will be takes place using conveyor belt which work by PIC controller.for sorting purpose we are using conveyor belt drive by DC motor.

**KEYWORDS**: fruit quality inspection, image processing, non destructive method, sorting

## INTRODUCTION

It is an important issue in produce logistics to inspect the quality of fruits using technique, such as storage, transportation and sale for their management. One of such inspection methods could be achieved by image processing which represent the quality status of tomato. In this method, fruits' image is extracted from their background for exactly using their surface color. For implementing this, fruits' color image is firstly taken by a CCD camera. The image is in the RGB color model, which is the most commonly used one. To extract hue (H) and saturation (S) information of a color image for color identification.

Fruit is grown as it has many vitamins and necessary nutrients for human bodies. Fruits, commonly consumed in daily diets, are a major source of anti-oxidants. There are a seasonal fruits and their availability is limited during certain seasons. Fruits find numerous uses in both fresh and processed forms. Processed forms include jam, paste and juice. Export of these processed products of fruits yield more income for the country. In order to get good quality of processed products the quality of fruits should be good. Identifying good and bad quality fruits in industries manually is the main obstacle as it is time consuming and for high labour cost.

Inspection of fruit quality So, the image is transferred from the RGB color model to the HSI then pass to the grey scale conversion. so that we can detect the ripeness level and defect if any.

For the sweetness detection solid sensor is use. Which is made up of copper strips which measure the moisture content in the fruit and give the voltage accordingly.this is the non distructive method for sweetness detection [1]
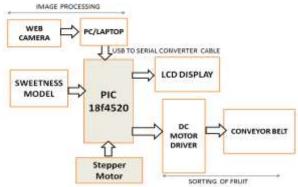
## METHODOLOGY



*Figure1 Block diagram*

## IMAGE PROCESSING
### RGB image
*RGB* is one of the formats of colour images. Here the input image is represented with three matrices of sizes regarding the image format. The three matrices in each image corresponds to the colours red, green and blue and also says that of how much of each of these colours a certain pixel should use.

### Background subtraction
Background subtraction is a process of extracting foreground objects in a particular scene of a image. A foreground object is defined as an object of attention which helps in reducing the amount of data to be processed.

### Gray image
Gray scale images have one colour which is a shade of gray in various ranges in between. Monochrome image is another name of gray image. This denotes the presence of only one (mono) colour (chrome). To convert any colour image to a gray scale representation of its luminance, we must obtain the values of its red, green, and blue (RGB) primaries in linear intensity encoding, by gamma expansion.[2]

### Ripeness level
Using IP we can check the ripeness level which is lies between 3 stages according to the colour green, orange or red.After that we compare that histogram with the histogram of ripe fruit histogram sample and by this comparison we can easily find the ripeness of given fruit. According to the colour histogram term is more often used for three dimensional spaces like RGB or HSV.



*Figure 2.ripeness level*

### Rottening detection
Rottening detection using image processing is possible .when there is any black spot or patches present on the fruit it means it its over ripened ,defected or rotten .which are not useful for further processing ,so we have to detect it .After the conversion of image from RGB to gray scale, the defected part can be easily identify so the detection get easy.[3][4]



*Figure 3. Images of rotten fruits*

## SWEETNESS DETECTION

Soil moisure sensor is use for sweetness detection.which is made up of two copper strips.we will provid voltage to one of the strip according to the moisture sensor the value of voltage will vary.this is the non distructive method where we touch the fruit to the copper strip and as per the moisture content will get the value at the output of another strip.Fruit sample as a dielectric placed between two copper strips. This output is given to the PIC controller . All voltage measurements, calculations and analysis operations are done by microcontroller and then results of ripeness estimation are shown on the display
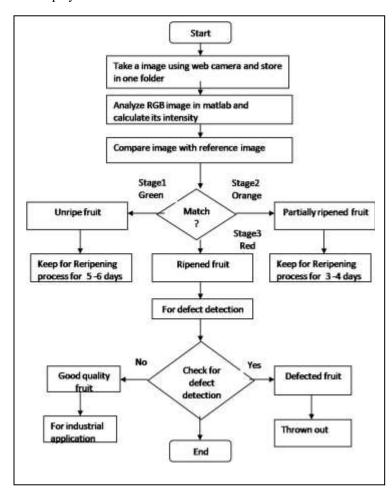


*Figure 4.algorithm*

## SORTING USING ARM AND CONVEYOR BELT

Initially different quality fruits are put in one box, the fruits send on conveyor belt which drive using two DC motor which rotate in same direction. Firstly the web camera will capture the image and send it to the pc for image processing in matlab.

Where it actually detect the ripeness level and rottening of the fruit .this will consider as an externally detect for internal detection instead of using destructive method. We use non destructive method which will check the sweetness by capacitance sensor.

After checking these three characteristics pic18f4520 will control the stepper motor accordingly.The good quality fruit will pass for further processing. Rotten fruit is eliminated and the unripened fruit will send to the input again using feedback system.
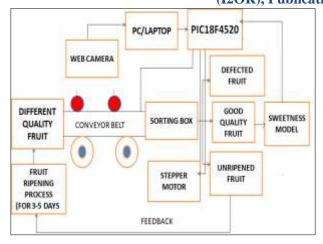
*Figure 5.implementation of model*

## HARDWARE
*PIC18F4520*
 It contains inbuilt ADC. It is a 5 port controller. Having capture compare mode Four timers.

*Stepper motor*
A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied.

*Web camera*
The camera is used to capture the image of the fruit and the image then send to PC for image processing. Here we are using IT306WC INTEX web camera and its resolution is 640X480.

*USB to serial converter*
UART- for serial communication between pc and microcontroller. The web camera is interface to the pc. We are using RS232 cable for USB to serial communication.

*Dc Motor driver and dc motor*
L293D is typical motor drive IC which is allows DC motor to drive on either direction. L293D is 16 pin IC which can control set of Dc motor simultaneously in any direction. DC motor is used to drive the conveyor belt

## RESULTS AND DISCUSSION
*Table 1. ripeness level and sweetness value*

| Sr no. | 1 | 2 | 3 |
|---|---|---|---|
| Image |  |  |  |
| colour | Green | Orange | Red |
| Ripeness level | Unripened | Moderately | Proper |

| | | Ripened | Ripened |
|---|---|---|---|
| Sweetness value | 30-50 | 50-70 | 70-90 |

## CONCLUSION

In this paper the identification of good, ripened and rotten fruits based on quality in image processing using MATLAB can successfully done with 80% accuracy. The use of image processing for identifying the quality can be applied not only to any particular fruit. We can also apply this method to identify quality of vegetables with more accuracy. Thus, this will enable the technology to be applied in many products. Also using dc motors-conveyor belt and stepper motor will rotate according to the command given by the PIC identified fruits can sort.

## ACKNOWLEDGEMENTS

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