ISSN: 2348-4098
Volume 3 Issue 2, 2015

FRUIT QUALITY MANAGEMENT AND SORTING SYSTEM

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ABSTRACT

This paper aims at presenting the concept of fruit quality management, a system which determines the quality of fruit by its color, size and weight. Sorting tons of fruits manually is a time consuming, costly, and an inaccurate process. This sorting system is developed in order to increase the quality of food products made from fruits. The sorting process depends on capturing the image of the fruit and analyzing this image using image processing techniques to discard defected fruits. The main emphasis is to do the quality check with a short span of time so that maximum number of fruits can be scrutinized for quality in minimum amount of time. The absolute reference point is the way to perceives and interpret the quality of fruit. This system performs the sorting using MATLAB software and gives some advantages over traditional practices.

Index terms: *sorting system, image processing techniques, quality check, MATLAB*

1. INTRODUCTION

Fruit quality management system based on image processing provides a fully automated system designed to combine processes such as feature extraction and sorting according to color, size and weight. For sorting using color and size after capturing the fruit side view image, some fruit characteristics are extracted by using detecting algorithms. Weight of fruit is used as a design metric in food processing. And for sorting using weight as a parameter the load cell arrangement is used.

Embedded system has the advantage of high accuracy of sorting, high speed and low cost. This proposed system will have a good prospect of application in fruit quality detecting and sorting areas**.** This system performs the sorting and quality check using MATLAB software and gives some advantages over traditional practices such as follows:-

1. Efficient way for fruit sorting
2. Less time delays
3. Quick response time
4. Fully automated system with low power requirement.

1.1 PROPOSED WORK

This automated system is designed to overcome the problems of manual techniques. Here the hardware model is designed which contains conveyor system, sorting assembly which contains a flapper to which DC motor is connected for moving in clockwise or anticlockwise direction, digital camera, IR sensor, LPC2138 Processor, load cell for weight measurement and an LCD display on field. The image will be captured using a webcam and its analysis will be done by MATLAB and the image with its characteristics will be displayed by the GUI(Graphics user interface). The system works on 12V dc power supply, and for the weight measurement purpose 5V dc power supply is used which is given to the load cell.

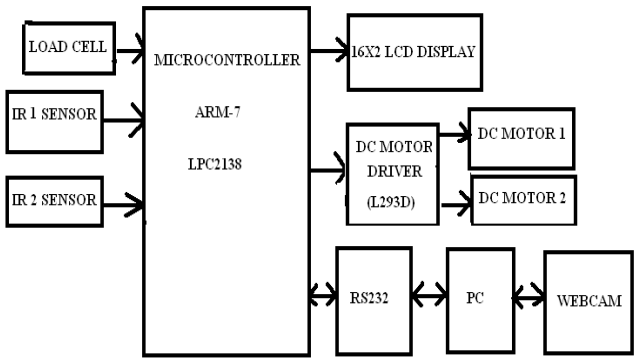

Figure 1 : Block Diagram of the system

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Volume 3 Issue 2, 2015

2. EXPERIMENTAL PROCEDURE

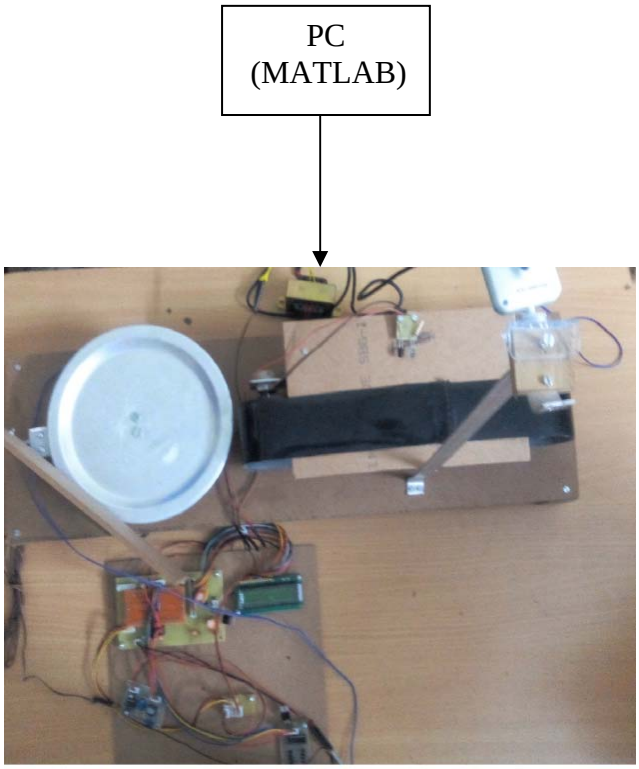

Figure 2: Experimental setup of the system

2.1 HARDWARE

IR SENSOR UNIT:

Here we have two IR based sensors, one is for detecting the fruit on the conveyor belt and the other is to detect the presence of fruit in front of the camera. After the first IR sensor gives the high to low pulse that is the fruit is detected on the conveyor belt, the belt starts to move in the forward direction. Next, the second IR sensor gives a low to high pulse when the fruit has reached below the camera. After this pulse is detected the µC then stops the conveyor and gives an indication to PC via RS232.The camera then clicks a photo of fruit and MATLAB software on PC further analyses the captured image.

LOAD CELL UNIT:

The load cell is used to log the weight of fruit. As soon as the fruit falls on the load cell the load cell with the help of signaling circuit will give the corresponding analog voltage to the Analog to Digital converter (ADC).The ADC then digitizes the analog value in HEX format. After this the HEX data is given to µC. The µC then displays the weight of the fruit on LCD

LCD DISPLAY UNIT:

Here we are using a 16 character by 2 line display in our project. The main objective to use LCD is to display the weight of the fruit and also to display the various processes and results obtained once the sorting process is complete.

PC UNIT:

In our project we are using MATLAB software on PC. The MATLAB language is used to mathematically analyze the color and also to determine the size of the fruit.

DC MOTOR UNIT:

We are using 12V DC motor to drive the DC motor based conveyor. The µC cannot provide the current required by the DC motor, so we are interfacing a DC motor driver L293D, which is used to drive the 12V DC Motor.

2.2 SOFTWARE

For programming the ARM7 microcontroller we have used the KEIL software which includes the µVision IDE/Debugger, ARM C/C++ Compiler and essential middleware components.

The process of extracting the features of the image captured by the camera and analyzing those features for sorting of the fruits is done by the MATLAB software based on image processing. The Graphics User Interface (GUI) in MATLAB is used to set the reference points for the calculating the size, height and weight of the fruit on the basis of which the fruits are sorted and the parameters:-height, weight, width, number of tested fruits as well as accepted and rejected fruits are displayed.

2.3 SYSTEM ARCHITECTURE

The entire system is designed over MATLAB software to inspect the color and size of the fruit. For capturing live image of a fruit the camera is continuously scanning the conveyor belt in video mode. The fruit is initially placed on the conveyor belt. The conveyor stops when fruit is detected by the IR sensor and camera captures the image of the fruit and this captured image is given as an input to the MATLAB software which extracts the color, height, weight and shape of the fruit. This data is transferred to ARM based system by using RS 232 and com port and accordingly control action takes place. The fruits fall on a plate after falling off the conveyor and then the flapper sorts the fruit one by one according to its features extracted. The graphics user interface displays the characteristics (color components, width, height) of the image captured and also the number of accepted and rejected fruits. Also the load cell arrangement determines the weight of the fruit

3. CONCLUSION

The system proposed here is a model which is designed to lessen the manual efforts of sorting the fruits. With the help of the MATLAB software on computer the features of the captured images are analyzed and the fruits are sorted into two categories mainly defected and healthy fruits with the help of the flapper. The GUI displays all the features of the sorting process and the number of fruits sorted.

ACKNOWLEDGEMENTS

We thank our project guide Mr. Devendra Itole for their valuable support and guidance.

ISSN: 2348-4098
Volume 3 Issue 2, 2015

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