IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 7, July 2016

Automated Fruit Classification System

Mr. Udamale Shivaji R.[1], Prof. Nitin Dawande[2], Prof. Ashish Mulajkar[3]

Student of Electronics and Telecommunication, D. Y. Patil School of Engg, Ambi, Pune, India[1]

Associate Professor & PG Co-ordinator, D. Y. Patil College of Engg, Ambi, Pune, India[2]

Assistant Professor Electronics and Telecommunication, D. Y. Patil School of Engg, Ambi, Pune, India[3]

Abstract: The Automated fruit classification system is totally based on new technology. Existing some systems are used for testing the leaf and fruit. This "automated fruit classification system" are also used for testing the quality of fruit. In a fruit market large amount of various fruits are available, and testing of this fruit or classifying a damaged and contaminated fruit is a very difficult to human. This system is very use full for handling such difficult task, this system automatically classify the good fruit and the damaged or contaminated fruit. This paper give us a idea about how to distribute the fruit according to the size, Quality, colour and health. This system is very use full for the framer and the fruit buyer. This system is totally based on image processing. This system has high accuracy of classifying fruit and it is a very big advantage of this system. This system strongly implemented in agricultural sector. Agricultural sector specially fruit cultivation. This paper has two units one is image acquisition and second is image processing because our system main part based on image processing.

Keywords: Automated, Image Processing, Embedded, agricultural, DSP, feature extraction, Edge detection.

I. INTRODUCTION

The "Automated Fruit Classification System" is embedded as well as image processing based totally automated system. We can use this system for classifying the various fruits like apple, orange, guava, etc. for classification purpose we can apply parameter like shape, size of fruit, fruit damaging level, contaminated level and its cleaning level. Using this parameter we going to classify the fruit. This system is very useful to the farmers. Fruit classification system is a totally automated and due to that it save the valuable time of the farmer as well as the buyers and customers. This system reduces the labor intensity and increases the quality of the fruit.

This system classify the fruits without any damage because of we going to use some standard rule of DSP and Image processing. The present existing technology are also used for fruit quality managing purpose but they are not more effective. They have some disadvantage like less reliability , less efficiency and less accuracy. That's why it is necessary to develop a new technology for fruit classification those consist of high accuracy, high reliability, and low cost. Here we have two choices for classification purpose, one by using the colour of the fruit and second is by using the size of the fruit. The first one is useful for identifying the colour of the fruit, colour of the fruit is used for classification purpose because some fruit are green, Some fruits are red in colour likewise that means all fruit are not in same colour.

Due to that we consider colour of fruit for classification purpose. Second one is size, size are used due to all fruit are not in same size and shape our existing system are used circular shape for grading. This system is software based that's why software designing is very important task as well as selecting appropriate algorithm for designing software. Our system is DSP and Image processing based that's why total coding is based on MATLAB. MATLAB is very powerful toll in DSP. Here grading can be categories into four ways Red small, Red big, Green small, Green big. We use the fruit like Apple and Tomato for demo purpose.

II. MATERIAL AND METHODOLOGY

Our system is totally automated and embedded based due to that our system required several hardware and one very well, error free developed Software. Hardware like ARM7, 4 Cameras, IR sensor, DC Motor, conveyer belt, power supply, LCD, Dc motor Driver, GSM Module, PC etc. Let observe the block diagram of the proposed system. This block diagram very useful for understanding the actually what is "Fruit Quality Classification System". Figure 1 is the block diagram of consist above mentioned material. All the hardware like DC motors, IR sensors, LCD, GSM module are interfaced to the ARM7 with the help of DC motor driver.

LCD Module, Digital Camera and IR sensors are also interfaced to the ARM7. IR sensors are used for sensing the fruit is present on the conveyer belt or not. If fruit is present on the conveyer belt then the system is going to start for further processing. We can also interface the GSM Module to this system for recoding Purpose.LCD used for displaying purpose it will display the total weight of the fruit.

This are the important material we going to use in this system. We can use the microcontroller like ARM 7 or ATMEL 32 and other appropriate material those have good quality and good stability, efficiency and reliability.

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940
International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 7, July 2016

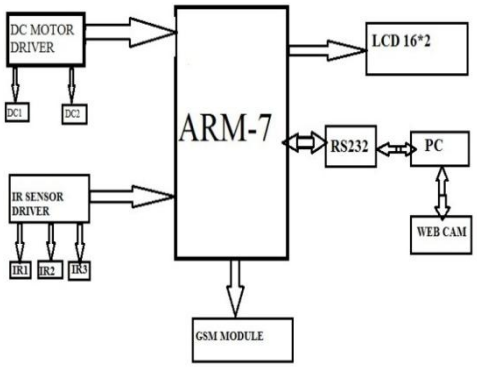

Figure 1: Block Diagram of System.

Methodology used in this system is detecting the size of the fruit and the colour of the fruit. According to the above mentioned part we require a goo algorithm for calculating the size and identifying the colour of that particular fruit. This algorithm is given below.

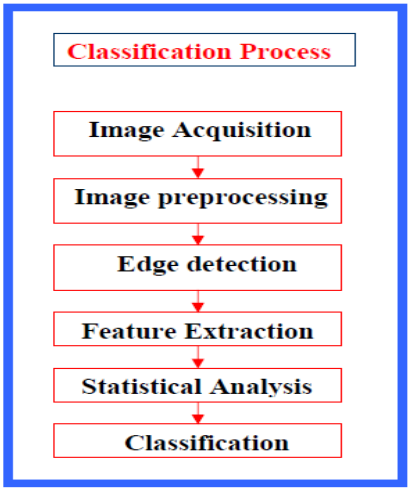

Figure.2: Fruit Colour and Size Detecting flow

In this method when camera capture the image then it flows the above steps serially. In that it also used some image detection technique like edge detection and other require steps. We also use the colour detecting algorithm on the same fruit. The some steps are as,

1) Read the input image,
2) Read the Pixel of colour image in RGB and store in variable r, g, b.
3) Read the small region of the fruit.
4) Calculate the Mean of r1, g1, b1 and store in variable r2, g2, b2.
5) Compare the value with Threshold.
6) If g2> Threshold then colour is Green.
7) If r2> threshold then colour is Red.

For detecting the size of fruit, we need one algorithm and this algorithm is.

First try to find out center co-ordinate of the image for that purpose we need to find edge sequence points i.e. $p(X_i, Y_i)$, i=1,…….,n. center co-ordinate of fruit shape is (C_x ,Cy) it can be calculated by equation 1 and 2 as in [1]

$$C_x=\frac{\sum_{k=1}^{n}[Y_k(X_k^2-X_{k-1}^2)-X_k^2(Y_k-Y_{k-1})]}{2\sum_{k=1}^{n}[Y_k(X_k-X_{k-1})-(Y_k-Y_{k-1})]} \quad (1)$$

$$C_{y=}\frac{\sum_{k=1}^{n}[Y_k^2(X_k-X_{k-1})-X_k(Y_k^2-Y_{k-1}^2)]}{2\sum_{k=1}^{n}[Y_k(X_k-X_{k-1})-X_k(Y_k-Y_{k-1})]} \quad (2)$$

Now try to find out Axis of Fruit.

$$g=\sum_{l=1}^{m/2} r(h+l)-r(h-l) \quad \text{where } (h=1,2,3,\ldots\ldots..m/2)$$

$$\text{If} \quad h\text{-}1\leq 1,\ r(h\text{-}1)=r(m+1\text{-}h\text{-}1) \quad (3)$$

Now diameter of the fruit image is

$$D=\ [(X1-X2)^2+(Y1-Y2)^2]^{1/2} \quad (4)$$

Using above equation we will find out the size of various fruit. And size is used for grading purpose that means we also classified the fruits according to their size also. Fruit size grading done with the help of diameter. For demo purpose we are taken the apple fruit and its grading result shown in below table 1.

Criteria	Diameter Size
Large	≥66mm
Medium	≥56mm

Table 1: Grading criteria

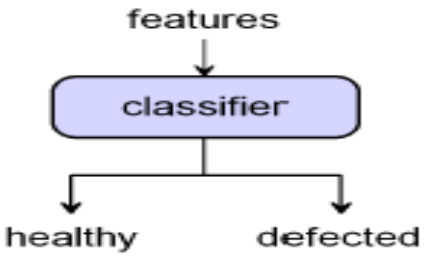

Figure2: Fruit Classification Output

Same criteria we can apply for the various fruit like Orange ,Watermelon, Onion etc. in this system capturing the image is very important task. Image should be clear once we get the clear image then the system process this image and sort out the fruits according to the requirement of the user. This system is based on DSP algorithm and the image processing, image processing is the very important part in this system. We also require the standard data base according to that system will classify the various fruits.

As mentioned above the fruits are classified according to the size and the colour. This happen following sequence, first check the colour of fruit. Here demo purpose we consider only two colour i.e. red and green. This is also mentioned in above algorithm. If the fruit is red colour then the conveyer rotate clock wise and drop in to the lower conveyer 1st belt otherwise conveyer rotate in anti-clock wise and fruit drop into lower conveyer 2nd .Once we detect the colour of the fruit then next step is that find out the size, for finding the size of red colour fruit the conveyer first is used if red colour fruit is small size then the 1st conveyer rotate clock wise direction and collect the

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 7, July 2016

fruit in that box, other wise the conveyer 1st rotate in anti-clock wise direction and collect the fruit in box automatically. Same procedure applied for the conveyer 2nd for calculating the size of green colour fruit.

III. RESULT

In the fruit classification system we use two important steps first is colour detection and second one is Fruit edge detection step. In colour detection we get the actual colour of the fruit and second step used for getting the actual size of the fruit. In edge detection step the original image converted in to gray image and grey image is very useful for detecting the edges of the fruit. In edge detection there are several method but we going to use canny method.

IV.ACKNOWLEDGMENT

The authors would like to thank Principal Dr. V. N. Nitnaware and Prof.Santosh G. Bari, Head of Department of Electronics and Telecommunication Engineering Dr. D. Y. Patil School of Engineering Ambi, I also Thanks to PG Coordinator **Prof. V. V. Thorat** and my guide **Prof. N. A. Dawande** & **Prof. Ashish Mulajkar** for continuously assessing my work providing great guidance by timely suggestions and discussions at every stage of this work.

V.CONCLUSION

The "Automated Fruit Classification System" is totally new system. That's why it will be very useful for in the agriculture sector for classifying the various fruit. We going to design this system only for demo purpose. We can implement this system in large scale also, we need to increase the length of the conveyer belt and the number of Cameras.

REFERENCES

[1] Hongshe Dang Jinguo song, Qin Guo, "A Fruit Size Detecting and v Grading System Based on Image Processing", 2010 second international Conference on Intelligent Human-Machine system and Cybernetics,pp8386.
[2] Jayaraman, S.Esakkiraian "Digital Image Processing", Tata Mcgraw Hill Publication.
[3] R. C. Gonzalez, R. E. Woods, "Digital Image Processing", Pearson Education. IIEd. 2002.
[4] Naoshi Kondo, "Fruit Grading Robot", Proceedings ofthe 2003 IEEE/ASME international conference Advanced Intelligent Mechatronics (AIM 2003), pp 1366-1371.
[5] J. V. Frances, J. Calpe, E. Soria, M Martinez, A. J. Serrano, J. Calleia, M. Diaz, "Application of ARMA Modeling to the improvement of weight estimation in fruit sorting and grading machinery," IEEE 2000, PP 3666-3669.
[6] Jain, A and Healey G, "A Multiscale representation including opponent colour features for texture recognition", IEEE Transaction on image processing vol.7, No.1 pp.124-128,1998.
[7] A. K. Jain, Fundamental of Digital Image Processing, Prentice Hall, 1989.
[8] N. Valliammal and S. N. Geethalakshmi, "An optimal feature subset selection for leaf analysis," International Journal of Computer and Communication Engineering, vol. 6, pp. 152-157, 2012.
[9] Harshavardhan G. Naganur, Sanjeev S. Sannakki, Vijay S R ajpurohit, Arunkumar R, "Fruits Sorting and Grading usingFuzzy Logic," International Journal of Advanced Research inComputer Engineering & Technology (IJARCET) Volume 1,Issue 6, August 2012,pp 117-122.
[10] John B. Njoroge. Kazunori Ninomiya. Naoshi Kondo and Hideki Toita, "Automated Fruit Grading System using Image Processing," The Society of Instrument and Control Engineers(SICE2002), Osaka, Japan, August 2002, pp 1346-1351.
[11] Fernández, L., Castillero, C. and Aguilera, J. M., "An application of image analysis to dehydration of apple discs" Journal of Food Engineering, vol.67, pp.185-193, 2005.
[12] Leemans, V., Magein, H. and Destain M.-F, "Defects segmentation on Golden Delicious' apples by using colour machine vision" Computers and Electronics in Agriculture, vol.20, pp.117-130,1999
[13] S.Arivazhagan,R.Newlin Shebiah,"Fruit Recognition using Colour Texture Features" Journal of Engineering Trends in Computing and Information Sciences,Vol.1No.2,Oct 2010.

BIOGRAPHIES

Mr. Udamle Shivaji Rohidas, Student of Electronics and Telecommunication, D. Y. Patil School of Engg, Ambi, Pune, India ,also Working as Assistant professor at HSBPVT'S COE ,Kashti

Prof. Nitin Dawande Assistant Professor and P.G. Co-Ordinator VLSI And Embedded System, D. Y. Patil College of Engg, Ambi, Pune, India

Prof. Asish Mulajkar Assistant Professor Electronics and Telecommunication, D. Y. Patil School of Engg, Ambi, Pune, India