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Object Identification and Recognition

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Abstract: This paper describes methods for object recognition and identification using various algorithms. The object is placed in front of the camera and image is obtained in certain angles. Various characters/parameters are extracted and grading is realized by using various criteria.

Keywords: Object identification, Recognition, object in background, fruit detection, quality of object.

I. INTRODUCTION

In the year 1970's Image processing is being introduced to scan images and detecting the quality and enhancing the images. Now the research is advancing in the fields of detecting the quality of the objects kept in front of camera through various programming languages and algorithms in image processing. Image processing concepts such as Haar cascade, Edge detection, Boundary Detection, and many other concepts related in the field such as negative of an image etc are widely used.

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. For the past several years the quality of fruits available in the market is significantly deteriorating. This is mainly caused due to injection of various chemicals in the fruits. Also, the fruits are waxed to produce shine.

This paper will help us to detect this low quality fruits. In this paper images will be captured using camera. The captured image will be further processed. This will be done using various algorithms in python. This paper will help us to detect the quality of fruits using various algorithms.

Identifying good and bad quality fruits manually is the main obstacle as it is time consuming. Therefore it is very important to identify the quality of fruits for the purpose of its usage by fruit detection software for various necessities. This paper will be very beneficial since grading the quality of fruits with naked eye is difficult.

II. REVIEW OF LITERATURE

The proposed system is a combination of image processing and artificial intelligence. The system identifies the object in front of it, recognizes it and gives its quality. It uses Open CV as its major library and algorithms in PYTHON.

Most literatures based on Object identification, recognition and quality focuses on various Edge detection, size detection algorithms, also it uses various classifiers like neural and SVM.

One of the works [1] has proposed fruit size detecting and grading system based on image processing. The system takes ARM9 as main processor and develops the fruits size detecting program using image processing algorithms on the QT/Embedded platform. This paper applied relative embedded technology in agriculture. A fruit size detecting and grading system based on image processing is realized. The system has the advantage of high speed, high measuring and grading accuracy and low cost.

Another paper [2] presents new integrated techniques for sorting and grading of different fruits. Generally image capture is a big challenge as there is a chance of high uncertainty due to the external lighting conditions, so the advantage of gray scale image is taken into account, which are less effected to the external environment changes as well as beneficial for finding the size of a fruit. Further MATLAB coding will be identified for different images of fruit in order to improve the efficiency.

Another work [3] on fruit quality management presents new integrated techniques for sorting and grading of different fruits. Few algorithms for edge detection, Colour grading and size detections are mentioned in this paper. Generally image capture is a big challenge as there is a chance of high uncertainty due to the external lighting conditions, so the advantage of gray scale image is being taken which are less effected to the external environment changes as well as beneficial for finding size of a fruit. Same way while collecting fruit from conveyor system by a main plate there is variation in the weight measurement of a fruit so further design can be modified so fruits can be collected stably. Speed and efficiency of a system can be further improved by using ARM9 or ARM11 processor for the same purpose.

Another paper [4] about fruit detection and counting gives a major idea to generate samples of scanned image. This process focuses on object counting on field. Sample region of fruit, leaf, branch and background is selected through polygon mapping. In this process cursor can be moved on the screen and the desired polygon can be drawn manually. This is very efficient process as it helps

us to select the desired colour region for segmentation. The system proposed in this paper can be used to automate the fruit counting process, which can be used further to save the money spent on manual counting as well as the loss due to erroneous estimations.

Authors in [5] have focused on the identification of good and bad fruits based on quality in image processing using MATLAB is successfully done with 80% accuracy. It majorly focuses on edge detection, feature extraction and feature matching. Canny edge detection algorithm has been used. For Feature extraction clustering algorithms can be used.

Feature matching is an important task in the area of image processing Here correlation method is used for feature matching. Here the clustered values of good and bad fruits are taken more in number. With the extracted features each value are correlated with one another and we get a specific value for good and bad fruit. With these values we can identify good and bad Fruits.

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.

III. PROPOSED METHODOLOGY

The proposed methodology is to develop a complete system to undergo colour detection before quality analysis and grading of the fruits by digital image. The whole system will be undergoing real time analysis. The image could be captured using a regular digital camera. Here the iball twist cam which is CMOS based camera will be used for capturing the image. The system arrangement is done as shown below the basic aim is to obtaining the fruit's features.
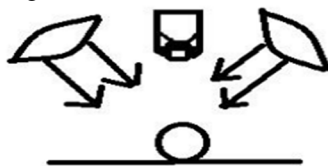

Fig 1 Tentative System Arrangement for image capturing

The system consists of several steps like feature extraction, sorting and grading. To avoid shadow, two annular lights are used to supply well- distributed light. The black background colour in image is easier to extract the fruit edge characters later. So the background is set black in whole process of image capture. The light and camera location is as shown in Fig 2.

As fruit is detected by IR system camera, it captures the top view image of fruit. The black background colour in image is easier to extract the fruit edge characters later so black colour is used for background. The captured image is given as an input to the MATLAB software which extracts (detects) colour and size of a fruit. If fruit is red colour (for an apple) (as detected by MATLAB) then it will show ' ripe', now depending on the size of fruit (as detected by MATLAB) it can be graded as a small or big fruit. If fruit is of big size it will show ' size - big' and if fruit is of small size it will show 'size - small', similarly, if fruit is of green colour (as detected by MATLAB) then it will show ' raw'.
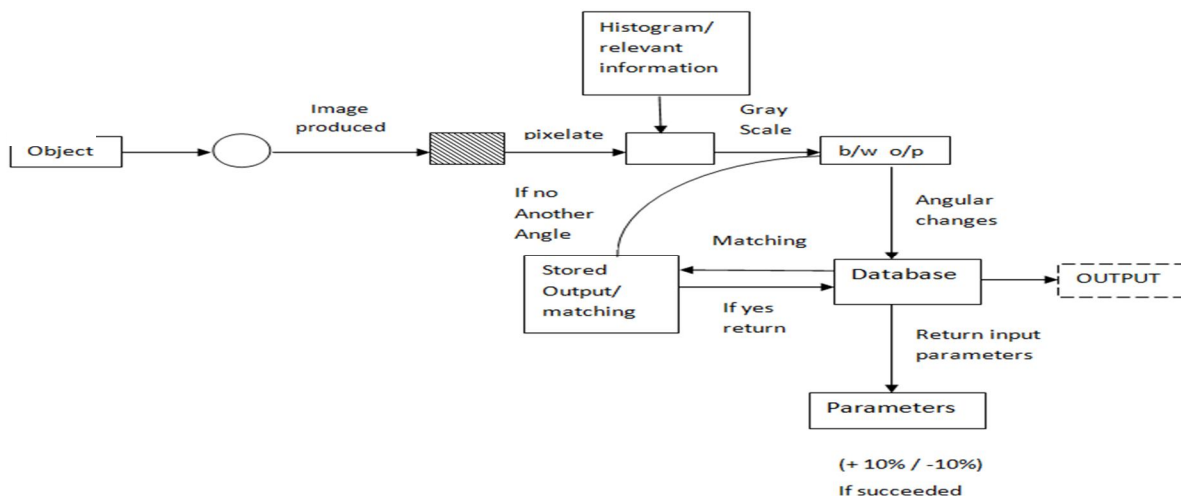
IV. SYSTEM DESIGN

Fig. 2 Flow chart of the system

The object chosen by the user is kept in front of the camera. Camera scans the provided object and the image is produced. It is converted to the pixels and its respective matrix format such as histogram by converting it in a black and white image.

Then that image is provided to the database and then it is compared to the image stored i.e. the training image and then if it is matched then it is assed to the parameters database section. If not matched then perspective Transform is applied and then it is passed to database till the picture is matched.

Then the parameters compared with the respective selected section and output is provided. Output is the name, size and the quality based on parameters.

V. ALGORITHMS

A. Colour Detection

In the process of fruit colour is detected according to RGB values, here fruits are sorted according to colour and size. For e.g. two fruits are considered say tomato having red colour and guava having green colour, so in this step work is going to find out colour of a fruit by using RGB values of an image taken from the camera, this image can be processed by using MATLAB software and accordingly colour can be detected i.e. green or red.

Colour detection algorithm:

1) Start
2) Read the input colour image using imread function.
3) Read the input pixel of colour image in three different planes (RGB) and store it into three variable r, g, and b.
4) Read the small region of fruit to detect colour of fruit.
5) Store in different variable r1, g1, b1.
6) Calculate the mean of r1, g1, b1 and store into variable r2, g2, b2.
7) Compare the value with threshold.
8) If g2> threshold, Colour detected is green.
9) If r2> threshold, Colour detected is Red.
10) End.

B. Edge Detection

Once colour is detected, there is a need to find out size of a fruit. The size of circular shaped fruit is its diameter. The edge extraction is key factor for size detecting. After gray image, the most powerful edge detection method that finds edge is the canny method. Various steps of edge detection are demonstrated in Fig. 3.
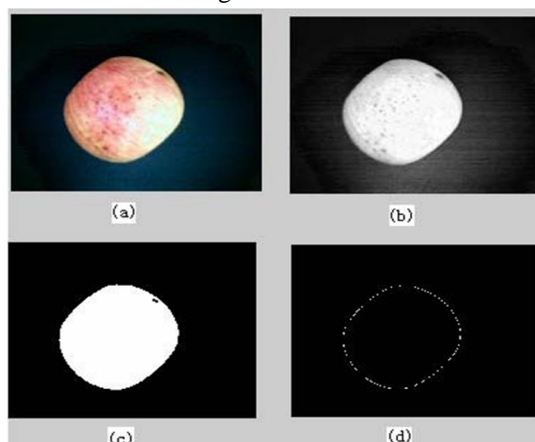

Fig 3 The processing fruit image. (a) The original image; (b) gray image; (c) diversion image; (d) tracking edge size Grading Output

The Canny method differs from the other edge-detection methods in that it uses two different thresholds (to detect strong and weak edges) and includes the weak edges in the output only if they are connected to strong edges. This method is therefore less likely than the others to be fooled by noise, and more likely to detect true weak edges

C. Fruit size detection

In order to calculate this diameter, the fruit's natural symmetry is considered, so the fruit size detecting algorithm based on its symmetry mainly contains two parts: finding the centre coordinates of fruit's shape in image and finding fruit's axis in image.

The algorithm is described as follows:

1) Finding the centre coordinate of fruit's shape in image: The centre coordinate can be easily calculated once finding the edge sequence points. Suppose the finding edge sequence point is q (xi, yi), i=1, n. the centre coordinates of fruit's shape is (cx, cy), it can be calculated by (1) and (2) as in:

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

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

2) Finding the fruit's axis in image: After getting the centre coordinates of fruit's shape in image, the diameter sequence from the edge point to the centre can be also acquired, that is p(j) j=1,…, n. and then it's even points selected from p(j) called r(j) ,j=1,…,m. suppose h =1,...,m / 2 .So the r (j) can be divided in two parts by h, and then calculating the g, which is described by (3).

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

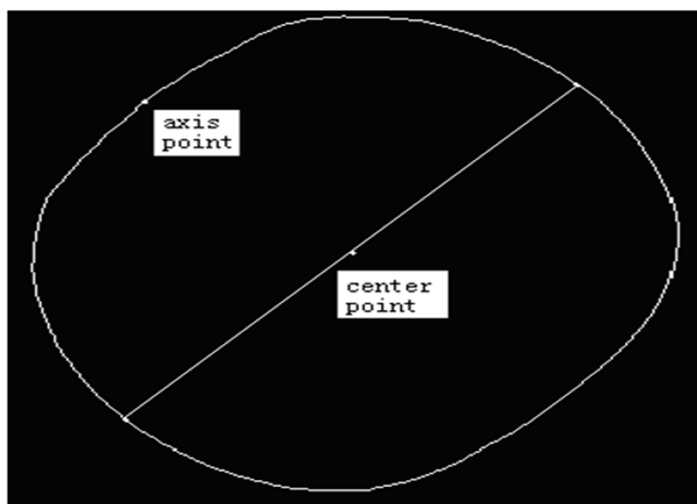$$\text{If} |h-1| \leq 1, r(h-1) = r(m+1-h-1) \qquad (3)$$

Fig 4. Fruit's axis point and the centre point location

The direction of r (h) is the fruit's axis in image while g the getting its minimum. Following the below method, the fruit's axis point and centre point is found in image as shown in Figure 4. Once known the axis point and the centre point, a line through the centre point which is vertical to the line from axis point to centre point will be crossed with the edge sequences, two edge points that on the line will be searched. Suppose the two points is (x1, y1) and (x2, y2) in order to improving the system's speed, the diameter is calculated by (4) indicates the fruit's real maximal diameter in image.

This method can find the axis point accurately in a fruit image. And also, it still can find the two points while the fruit's location changed. So this method can satisfy the fruit size detecting on line which its location changed often

$$d = [(x1 - x2)2 + (y1 - y2)2]1/2 \quad \ldots(4)$$

D. Fruit Size Grading

According to apple state criterion, size grading is judged by the detected diameter of an apple, the criterion is shown as the table 1.

TABLE 1. Apple Size Grading Criterion (mm: Millimetre)

Criteria	Diameter
Small	>60mm
Big	<50mm

VI. IMPLEMENTATION

A. Haar cascade implementing steps:

Training steps to create a Haar Classifier:

Collection of positives and negative images.

Marking positive images by using objectmarker.exe or Image clipper tools.

Creating a vector file based on positive marked image using createsamples.exe

Training the classifier using haartraining.exe

Running the classifier using cv Haar Detect Objects()

1) STEP1: Collecting Image Database.

2) STEP2: Arrange Negative Images.

3) STEP3: Crop and Mark positive images.

4) STEP4: Creating a vector of positive images.

5) STEP5: Haar training.

6) STEP6: Creating an XML file.

7) STEP7: Copy it in Mycascade folder and execute it.

Write the python code to access the web camera on the device; nest the cascade.xml (Haar training file) in the program. Include the open CV library and numpy library. Now run the program to get your desired output.

VII.   CONCLUSION

This paper represents a solution for scanning detection and recognition of objects, intended for use by the factory outlets. A key feature of the algorithm is the ability to detect objects at some distance, allowing the user to rapidly scan objects for quality detection. Experimental results with various objects demonstrate the feasibility of the system.

A. Future Scope of the Paper

In future the proposed methodology can be integrated with other yet to be developed methods, for disease identification and classification using colour and texture analysis to develop an expert system for early fruit disease warning and administration, where the disease can be identified by colour and texture analysis and the severity level estimation by our proposed method since it is disease independent.

The performance of the system can be improved in the future by using advanced background separation methods to separate the object from complex background. The similar technology can be used for quality detection of various vegetables and beans as well. The use of other sorting and grading methods can be exploited to improve the accuracy of the system.

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