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Disease and Quality Identification of Tomato using Image Processing Technique

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***Abstract*—Tomatoes are the best-known grown fruit in greenhouses that have been recently attempted to be picked up automatically. Tomato is a plant which its fruit does not ripen simultaneously; therefore it is necessary to develop an algorithm to distinguish red tomatoes. A new segmentation algorithm based on region growing was proposed for guiding a robot to pick up red tomatoes. For this purpose, several color images of tomato plants were acquired in a greenhouse. The color images of tomato were captured under natural light, without any artificial lighting equipment. To recognize red tomatoes form non-red ones, at first background of images were removed. For removing the background, subtraction of red and green components (R-G) was applied. Usually tomatoes touch together, so separating touching tomatoes. The watershed algorithm was used that was followed by improving tomato. Afterwards, red tomato was detected by the region growing approach. Results obtained from testing the developed algorithm showed an encouraging accuracy (95.79%) to develop an expert system for Online recognition of red tomato and disease prediction.**

***Index Terms*— USB Camera, MATLAB, GSM module, tomato ripening stages.**

I. INTRODUCTION

Tomato belongs to the Solanaceae family, native to central, South and Southern North America from Mexico to Argentina that was rapidly spreading to other parts of the world due to its importance and popularity. Tomatoes are daily consumed by millions of people for its valuable nutrients. In addition to the high amount of vitamin C and A, tomato contains several nutrients such as Calcium, Phosphorus, Potassium, Iron and Copper. Cultivation of tomato has greatly increased in recent years. According to the FAO statistics, world production of tomato in 2011 was about 159 million tons. In 2011, Iran with 6.82 million tons of harvested tomato has been ranked 6th in the world that shows an increasing trend compared to past years. Recently, greenhouses are considered as a place for growing agricultural crops during the year. Nowadays, the main obstacles at expanding greenhouses are high, labor costs and consuming them. Automatic robotic harvesting can effectively be in concert with the growing greenhouse, because the automation of fruit harvesting operations decreases labor costs and improve the efficiency. It carried out to design, harvesting robots pick up fruits on trees. In most cases; leading robot was carried out using a vision based system. The first step in developing a robotic system is recognition of a fruit. The RGB model was used for recognition of cotton, and the R-B relation was defined for this purpose. In another effort, a color-based algorithm was developed for the automatic recognition of tomato on the tree. During ripening procedure, the color of tomatoes varies from nature green, yellow and orange to intense red color. Then a robot should pick up only red tomatoes and leave others.

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Many studies have been conducted to develop an expert system for picking red tomatoes. Most of them were based on color feature because the color is as an effective factor of the tomato quality.

II. Existing System

The quality of tomato only analyzes so no disease occurs which is not affected by human. Generally it can be identified by human experts, but through eyes, it has resulted in a serious problem because misjudgment occurs frequently due to recurring fluctuations in quality identification criteria. This issue motivates intensive research work to implement flexible and effective systems to sort tomatoes. Drawback:

1. The Accuracy level is very low.
2. It can only detect whether the tomato is ready to market or not.

III. Proposed System

Instead qualities of tomato disease also analyze our proposed system. The purpose of this work is to develop a segregation system for analysis of tomatoes based on color based image analysis. It is now an essential parameter to obtain the advance visualization techniques for the safety of fruits and vegetables. The analysis of an age factor of tomato based one of the visual features of tomato.

Need of Image processing:

1. Visualization - Observe the objects that are not visible.
2. Image sharpening and restoration - To create a better image.
3. Image retrieval - Seek for the image of interest.
4. Measurement of pattern – Measures various objects in an image.
5. Image Recognition – Distinguish the objects in an image.

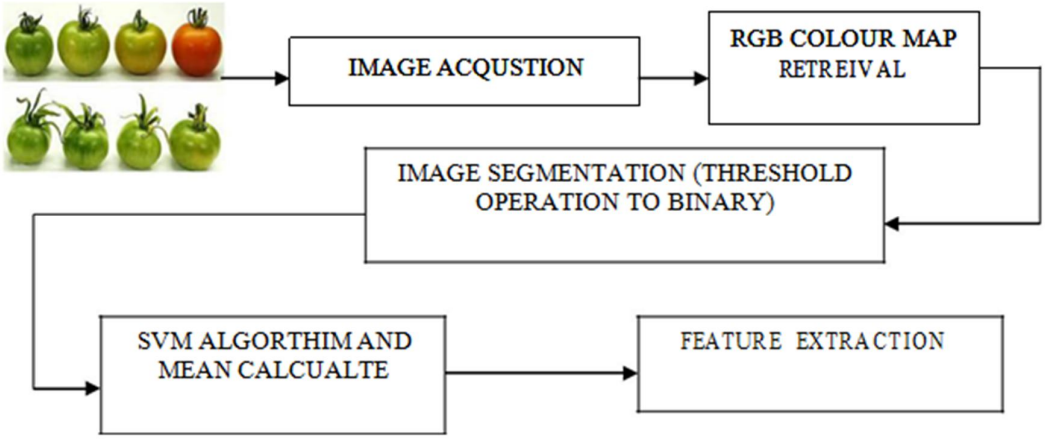

Fig1.1Block Diagram

IV. Methodology

A. Modules

The methodology contains two stages:

1. Image Acquisition and Pre-Processing
2. Image Segmentation

Image Acquisition and Pre- Processing

The images were captured using a high professional camera (canon DSLR 700D). Those images contain higher amount of image file size. An experiment was conducted in MATLAB (R2016a) with windows platform. The captured image is in RGB color space which resizes those images for our research that is 300*400 pixels to reduce computational complexity. To get better result, it is necessary to increase brightness or shining of the input image that called as contrast image. Contrast is different in illumination or color that makes an object or

representation in an image distinguishable. To remove noises a simple median filter is applied. After image pre-processing generated image is contrast image.

Image Segmentation
Image segmentation is nothing but partitioning an image into some similar features. Segmentation is using done using different methods like k-means clustering, converting RGB to HSI model etc.

Segmentation using spot detection RGB image is converted to HSI model for segmentation. Using spot detection infected part of the tomato can be found. HSI stands for Hue, Saturation and Intensity. When a human view a color object, it is describe by its hue, saturation and brightness.

K-means clustering the k-means clustering is used for classification of objects based on a set of features into k number of classes.

The algorithm for K –means Clustering:

1. Pick center of K cluster, either randomly or based on some heuristic.
2. Assign each pixel in the image to the cluster that minimizes the distance between the pixel and the cluster center.
3. Again compute the cluster centers by averaging all of the pixels in the cluster.

Classification
Image classification analyzes the numerical properties of various image features and organizes data into categories. Classification is a general process related to categorization. Image classification refers to the task of extracting information classes from image.
There are two types of classification: supervised and unsupervised. It used supervised classification because our target data is known, that is tomato is diseased or healthy represented as 1 and 0.

SVM (Support Vector Machine)
SVM is working in high-dimensional spaces seeking an optimal hyper-plane to separate the categories. SVM comprise of a set of related supervised learning methods used for classification and regression. SVM database contains equal images of infected and non-infected, so it is easy to train all the images. Here we used supervised data. SVM is used for decision making. It is suitable to work with high dimensional data. But it can work only with two classes. Using SVM, quality identification of tomato is successfully performed and it gives 95% accuracy.

V. RESULTS

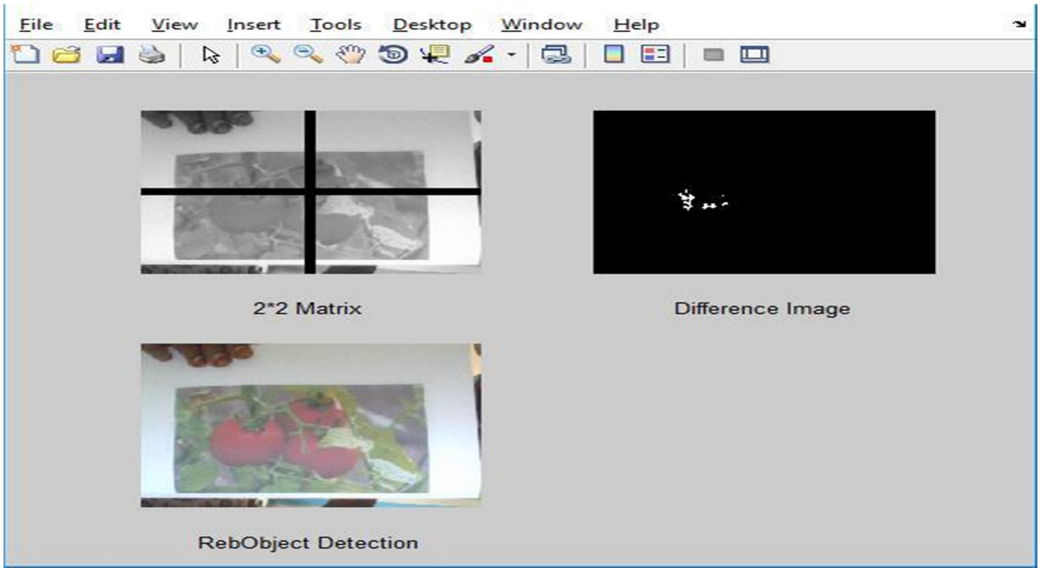

Fig5.1 Image Detection

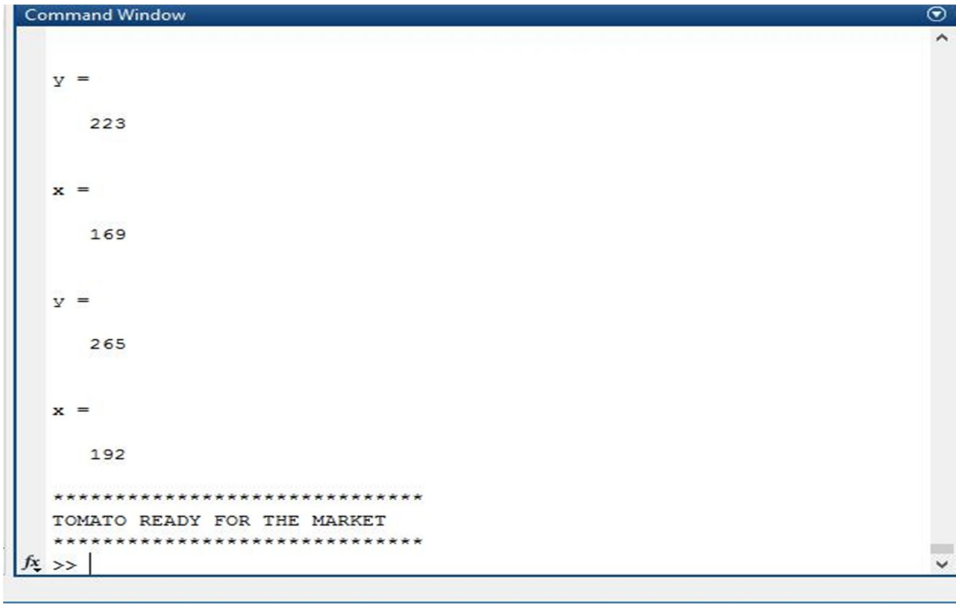

Fig5.2 Image Direction

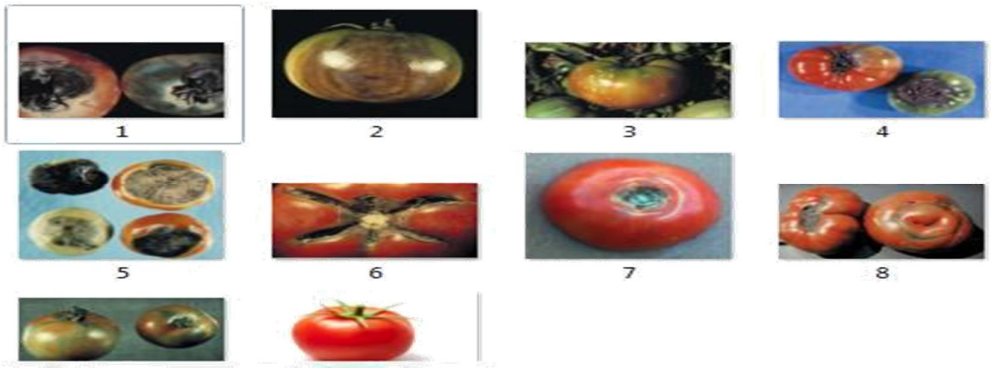

Fig5.3 Disease Occur Images

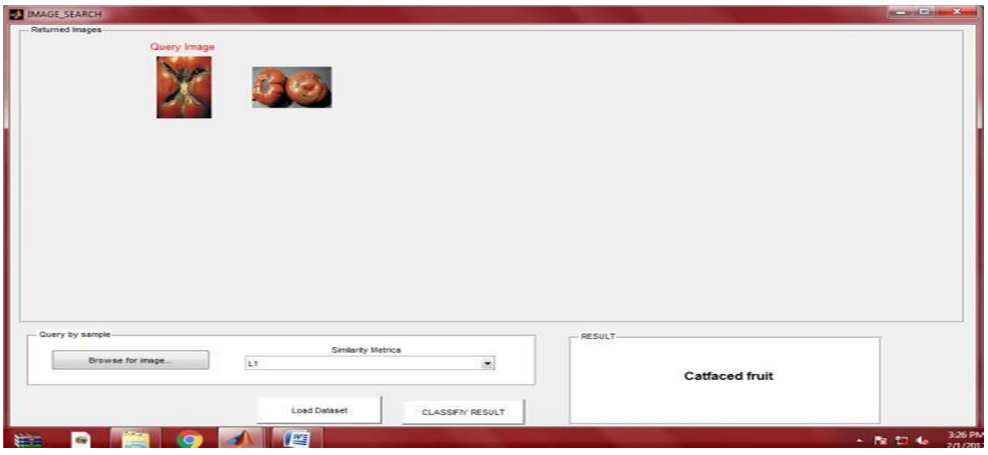

Fig5.4 Disease Occur Catfaced Fruit

VI. Conclusion

Two relations R-G and R-B were defined to remove the image background. Results showed that removing the image background was successfully done by R-G relation because it could make a high contrast between the tomatoes and the background. If the overlapped tomatoes were not separated, watershed algorithm was effectively improved and could separate touching tomatoes correctly. After separating touching tomatoes, it would be possible to determine the location of each individual tomato. Results showed that the region growing algorithm could consider as a useful method at recognizing red tomatoes at harvest operations. Overall classification accuracy was 95.79 %. It used to monitor the condition of tomato based on the colour index at different ripening stages. It is a low cost, and real-time system which aims at in helping the farmer to take the advantage of technology in the field of agriculture. The ripening stages of other fruits and vegetables can also be detected and informed to the farmer.

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