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Fruit Quality Analysis Using IOT and AIML

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***Abstract* —**In recent years, the application, advancement and development of image processing and analysis in the quality assessment of agricultural products and foods has advanced rapidly. Images are a vital source of data and information in agriculture. Emphasis is placed on the basic concepts and techniques of computer vision, as well as tools for image analysis, distribution and grading. Due to overcrowding, losses during handling and processing, and increasing confidence in food safety and fruit quality, there is a need for objective, accurate and rapid decision making regarding related products in India. Computer vision is a fast and consistent objective inspection technique.It is also inexpensive, and spans across many different industries.

Our process includes good accuracy as well speed to meet the quality requirements, thus facilitating the development of high-performance systems. This non destructive type of testing method has its application in the agribusiness and food industry, which includes the quality inspection and evaluation of fruits and vegetables.

Machine vision technology is now widely used to monitor fruit quality. Taking pictures is often the first step in checking fruit quality. The process begins with an image of the fruit using MATLAB.

The image then moves on to the processing stage, where it can extract features such as the size, shape, and color of the fruit. This is done by making images. It helps to determine the shape, size and color of the fruit and compare it with the information learned. This is done during training and testing.

Keywords —- Fruit Quality, Agricultural Products, Image Processing, Crop Quality, Soil Analysis, Pre Harvest Stage, Post Harvest Stage, Food.

I. INTRODUCTION

Many activities in agriculture are manual, time consuming and difficult and tiring for the operator due to the conditions present during that time. With advances in technology which have taken place of late, such as image electronic devices, new technologies are being used to make many jobs possible, resulting in great work and productivity. However, there are still many difficulties and problems to be solved. In the present world, we can see that almost every system is automated and intervention of such systems becomes an ineffective solution with a waste of time. When it comes to fruit, its delicate aspects such as food and hygiene become most important when processing fruit.
Through this project, we will automate fruit quality analysis and check whether the fruit is acceptable or not, post which products can be used or destroyed. This automated model is made to overcome manual problems, and here a hardware model is also designed for other functions. This model encloses mostly all the business processes; preharvest, harvest and postharvest. Farmers have identified issues that need to be addressed in the following points: Soil analysis, Seeds, leading to, growth, health and reproduction in the future,, Crop location and inspection and forecasting, Plant management and technology, Recording, guidance and safety, Control of microbial diseases and pests, and Good products.

II. RELATED WORK

1. Fruit Quality Management System which is Based On Image Processing, published during Nov-Dec 2013, Volume 8, Issue 6.

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III. METHODOLOGY

A. WORKING

Given the different situations and possible configurations, tasks focused on searching, running the area and calculating scores are optimized to bring down costs and avoid unwanted errors caused by tiredness and long working load on the body. Also, one of the biggest challenges of the agriculture industry is the changing environment (soil, weather, pests and plant diseases), agriculture (water, pesticides or fertilizers) and agriculture (pruning, dilution). Uncertainty about how these conditions affect crop quality makes housing management difficult. Therefore, crop forecasting is an important issue in accurate farming automation. The automated assessment of yields is dependent on the total count of agricultural items like fruits or vegetables and trees in images with the help of algorithms dependent on imaging processing and analysis

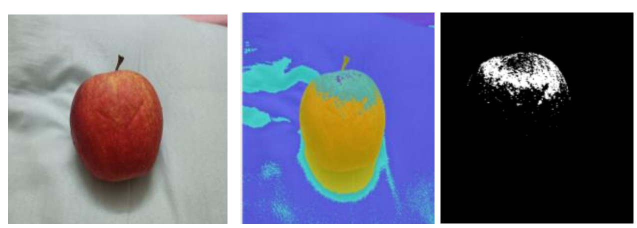
Depending on the ingredients (fruits, vegetables) and properties, these ideas can be more or less. For example, opacity issues, difference in color between the background, subject and lighting or the size of objects are the few of the big issues that need to be overcome.

This project presents a system based on image processing which finds the maximum height of sphere shaped objects. The report in this section demonstrates the development of a new pre-harvest program for counting fruits in original images taken at night in very good lighted conditions. The new provisions of this article is the use of lighting to show the clarity of fruit orbs.

Figure 5 shows peak detection.

Figure 1-a shows the details of the original image, while Figure.1-b shows the normal grayscale image form showing the hotspots of the fruits. The forecast is of interest in good agriculture as it can improve property management. Presently, yield prediction consumes a lot of time, gives inaccurate data and information, and is pretty expensive as it is done by hand by workers who count the fruits.

Projects for the calculation of agricultural content were made operational by using image processing techniques. This automated process has given better efficiency, faster response time and is less inconsistent. However, factors such as environment, crop characteristics, occlusion and poor lighting can hamper the computational performance.



a b c

Fig 1. Sample of working model output (**a**) Original image; (**b**) Grayscale normalized form of image. (c) Damaged highlighted image

On-line automatic and individual nectarine variety validation during the packaging line is done by the comparison of trait histogram graph vectors calculated by the peel process with those obtained from representative nectarines of the target variety currently retained in the analysis dataset for many fruits. Avoid taking the fruit as it is incompatible with other things. Finally, the histogram of the skin is calculated and created by merging the graph values corresponding to different color layers such as RGB, HSV, YCbCr, RGB to create the nectarine analysis number.

B. COMPONENT LIST

- Color sensor
- Arduino Uno
- LCD Display
- Power Source

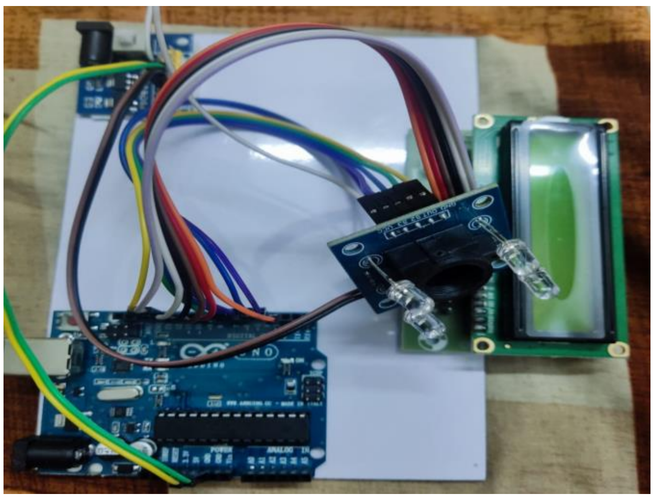


Fig 2. Sample Model of the IoT Module

C. MODULES

1.CAPTURING IMAGE

The initial step of making the pictures is explained below, this is just a snapshot. Image capture is done with the help of a camera or scanner, in this project we are using smartphone cameras as of now. Details of captured image and data are described. This phase contains photo capturing. Enhancing the light in the room will improve the detection of rgb values and help the color sensor to give more accurate results.

2 IMAGE PRE-PROCESSING

Now after capturing the image, preprocessing is the second step in our model. It uses digital image processing. Preprocessing is to change the color captured in the image from binary code to Gray code from a system perspective for further analysis and data processing.

3.SEGMENTATION OF IMAGE

This is used for segmentation of colors to identify differences between fruits. Therefore, we split the data to examine methods for classification of fruit color as shown below. The process should come to a halt when the object in the frame is isolated in the application. The image comparison does the pixel multiple ratio ($a > 200$, $a > 500$, $a < 1000$).

4.CLASSIFICATION OF IMAGE

Fourth and the next step is to separate the image, the classification of fruit color depends on the information given in the image segmentation section, at this point further separate the fruit color. Investigation of good fruit quality using data classification is widely used data extraction methods. Classification of the images is based on the labeling of a small points or a group of points, from binary to grayscale values.

5.OUTPUT

The output shows part of the fruit which is damaged, with accuracy, classification and damage percentage.

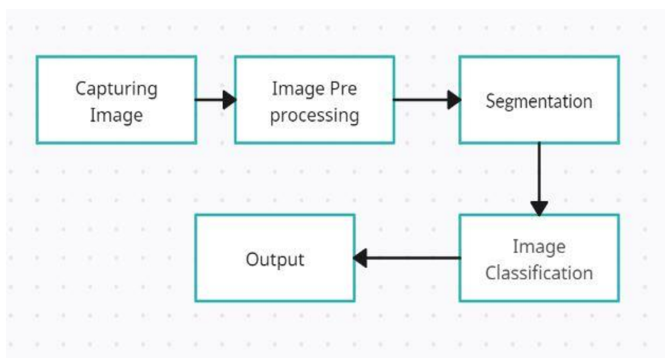


Fig 3. Architecture of the Project

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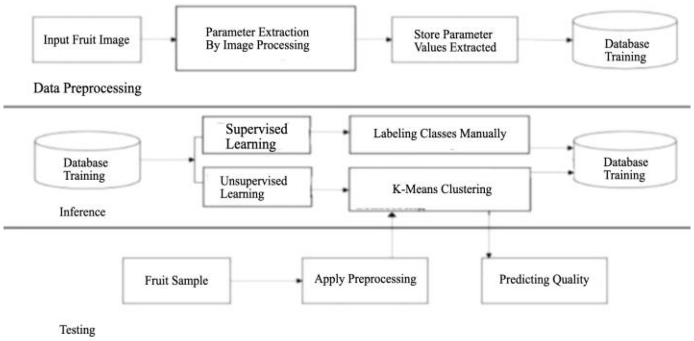

Fig 4. UML Diagram

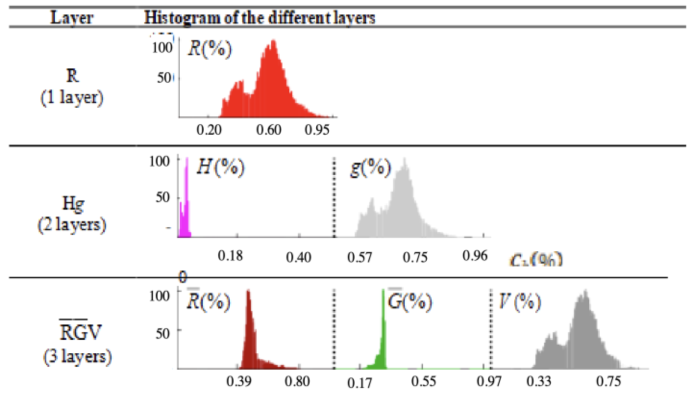

Fig 5. Graph showing examples of intensity of colors from different color regions..

IV. ANALYSIS AND VALIDATION

Method of mapping the agricultural area in the pre-harvest stage: counting red fruits. Count the fruits in the field by detecting the sphere shape in the RGB image obtained with night lighting. Image processing to estimate size, distance and location Fruit picking phase: automatic fruit picking. An imaging method as a tool for fruit quality control at the postharvest stage: Identification of nectarine cultivars. Image processing as a tool for monitoring fruit quality at the postharvest stage: relationship between quality indicators and the visual spectrum of fruit peel.

Validating the proposed model is based on contrasting the different skins of graph vectors; one defines the existing types and the other represents the selected types kept in the database. Two methods were put in action to evaluate the comparison: first one being the Pearson Correlation coefficient and second one is application of the full test. An important step in the testing process is the estimation of the start of classification of the crop, representing the minimum similarity used to determine if it is acceptable as a part of the current nectarine variety. Automation of the estimation process of this parameter is done by comparing it to all unique histogram vectors found in the data.

V. RESULT

Fruit quality calculated by the model with decent accuracy and efficiency. The skin color, diameter, weight, pulp hardness, SSC and titratable acidity. In contrast, non-contact measured skin appearance is defined using the RGB, Grey, HSV, and CIELab color space. The different fruits that were tested and its poor quality was estimated with a special device. Let's take an example: length was measured with digital caliper, weight was measured with digital scale, skin color was measured with Chroma Meter. An experimental procedure to mix 100 mL of juice, 100 mL of distilled water and 10-15 drops of phenolphthalein, the digital refractometer (PR32 model) and TA, instead, the visible spectrum of the fruit peel is measured using image detection, image processing and image analysis.

There are four steps. First, convert the image of the liquid to grayscale. Then apply the transformation using the rectangular window and the local threshold to get the fluid silhouette. The upcoming step is to remove the noise and those pixels. Removal is done from the binary-form image using operations that are morphological; product labels and batch filtering (value is derived through trial and error method).

The final process is to create a connected box which will contain the juice sample used to identify the two circular areas; central region and central region. These Areas will be the representative areas of the liquid for calculation of the average visible spectrum. The area that was judged unsuitable for analysis due to special needs was the middle area, while the right middle area showed more variation during the experiment and thus well again represents the conversion of parameters.

Finally, it has been determined that most of the post-storage bad juices can be caused by contact and even damage measures are related to the appearance of the rind of the fruit. The results show that the values obtained from the contact measurement were moderately related to the color layer used in the RGB color space of the identified apples.

A set of similar results was obtained using the CIELab color scheme. Therefore, most fruits can be predicted using image analysis-based techniques, which is faster, gives better efficiency and is less expensive.

Future enhancements will focus on developing new imaging techniques to predict new postharvest fruit quality.

VI. CONCLUSION

The project focuses on the automation of agricultural operations, including all phases of the business process. The main results in this area are:

Pre-harvest stage:
Red grape image processing with different degrees of occlusion. The automatic applica- tion process can detect not only visible fruits, but also fruits with higher people and less than 75% occlusion. In addition, the method can count very good fruits with low yield. It is concluded that the proposed automated method has -14% average calculation error and low cost (7%).

At harvest:
Results from harvesting usable fruit using recommendations for fruit size, distance and estimated location. In addition, the full model as a robotic arm has been tested in the laboratory and can lift a target pear in 16 seconds.

Post-Harvest Phase:
The Nectarine Variety Verification System concluded that automated machines (100%) weed more efficiently than experienced workers (87%). Best results for automated method were obtained with a 100% success with the Pearson comparison test and 90% with the pooled method. However, comparing subtraction numbers is faster and may be a viable alternative for practical use.

Analysis of fruit quality results after storage and visual spectrum of the peel showed that most of the juice was not good and could be obtained by contact.. Damage measurement can be evaluated using less time consuming methods which work on functional image analysis which is a non-contact measurement method. We can conclude that the product of the CIELab color space provides the best relationship, although Red and Blue use the color layer from the RGB color spectrum to provide a good relationship. However, the best correlation is achieved by the SSC parameter, which shows flat progress throughout fruit ripening.

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