

Android Based Application for Fruit Quality Analysis

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ABSTRACT: This paper presents the incorporation of mobile applications technology in the field of agriculture to ease the human labor intensive process of grading fruits, apple. It is an android based application for quality grading of the fruit like apple. It shows implementation of a grading technique based on android platform used in handy mobile phones. It uses a clustering algorithm for effective grading of the fruit apple by using parameters like color on the fruit's surface, weight of the fruit in grams, size of the fruit. The grading analysis is done by capturing four different images of apple with the help of mobile phone's rear camera, provided that the camera is digital with minimum 2.0 megapixels resolution for crystal clear images. Automated grading system not only speeds up the time of the process but also minimizes the errors thereby increasing the accuracy of the process. The main purpose is to detect the defects in the outer skin of the fruit and categorize the apple in various grading classes viz. average, good, moderate. Clustering algorithm offers effective grading with accurate, reliable, consistent and quantitative information apart from handling large volumes, which may not be achieved by employing human graders.

KEYWORDS: Mobile, human labour, grading, clustering algorithm.

I. INTRODUCTION

Android is widely used since it's very powerful and has greater accuracy and one can handle it with ease. Android is the world's most widely used smart phone platform and the software of choices for technology companies that require a low cost customizable light weight operating system for high-tech devices without developing one from scratch.

With Android, you can create a unique mobile experience that's just right for you. Hence many applications based on android can be developed, that can be used on a daily basis to get our work done precisely. But one such use of android technology has not yet effectively explored in the field of agriculture for effective grading, so there was a need to develop an application that could detect the defects in a fruit like apple using an algorithm or a technique which could be simple to implement and easy to be used by the end user. Android based application of fruit(apple) quality grading is such an application which takes parameters like colour measurement, size of the apple, weight of the apple in grams, defect percentage in the fruit to give precise grading results. To make the application less complex and handy for use it is implemented in the mobile phones and clustering algorithm is used for grading process. The main constraint for grading of the apple is its surface's red colour and based on the clusters of non-red areas on the apple's surface, weight of the apple the defect percentage is calculated. For this purpose, four different images of the same apple are captured

International Journal of Innovative Research in Science, Engineering and Technology

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using the mobile phone's rear digital camera with minimum resolution of 2.0 megapixels for crystal clear images. This application works in three phases.

The first phase includes capturing image of the apple from four different angles like top, bottom, left, and right. In this phase user captures the image of the apple with the help of camera and image is viewed on the screen, if the image isn't properly clicked then user can click on retry option and click a new image. The second phase is for adding the weight of apple manually and then four captured images are processed for calculation of defect percentage. The third phase consists of displaying the result grading process. In this phase the result is generated based on the average defect percentage calculated with the help of the captured images of apple and weight of the apple entered manually. Finally the user can see the grading class of the apple which is either of three classes i.e. average, moderate, good.

Section II describes system architecture for Android Based Application for Fruit Quality Analysis, Section III shows the complete working of Android Based Application for Fruit Quality Analysis and finally Section IV gives advantages, Section V shows conclusion, Section VI shows Future scope.

II. RELATED WORK

Initially developed by Android, Inc., which Google backed financially and later bought in 2005, Android was unveiled in 2007, along with the founding of the Open Handset Alliance—a consortium of hardware, software, and telecommunication companies devoted to advancing open standards for mobile devices. Android is popular with technology companies which require a ready-made, low-cost and customizable operating system for high-tech devices. Android's open nature has encouraged a large community of developers and enthusiasts to use the open-source code as a foundation for community-driven projects, which add new features for advanced users or bring Android to devices which were officially, released running other operating systems. The operating system's success has made it a target for patent litigation as part of the so-called "smart phone wars" between technology companies. On top of the Linux kernel, there are the middleware, libraries and APIs written in C, and application software running on an application framework which includes Java-compatible libraries based on Apache Harmony. Development of the Linux kernel continues independently of other Android's source code bases. Until version 5.0, Android used Dalvik as a process virtual machine with trace-based-just in time compiler to run Dalvik "dex-code" (Dalvik Executable), which is usually translated from the Java byte-code.

Following the trace-based JIT principle, in addition to interpreting the majority of application code, Dalvik performs the compilation and native execution of select frequently executed code segments ("traces") each time an application is launched. Android 4.4 introduced Android Runtime (ART) as a new runtime environment, which uses ahead-of-time (AOT) compilation to entirely compile the application byte-code into machine code upon the installation of an application. In Android 4.4, ART was an experimental feature and not enabled by default; it became the only runtime option in the next major version of Android, 5.0. Android's standard C library, Bionic, was developed by Google specifically for Android, as a derivation of the BSD's standard C library code. Bionic itself has been designed with several major features specific to the Linux kernel.

III. SYSTEM DESCRIPTION

Detailed design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. There is some overlap with the disciplines of systems analysis, systems architecture and systems engineering.

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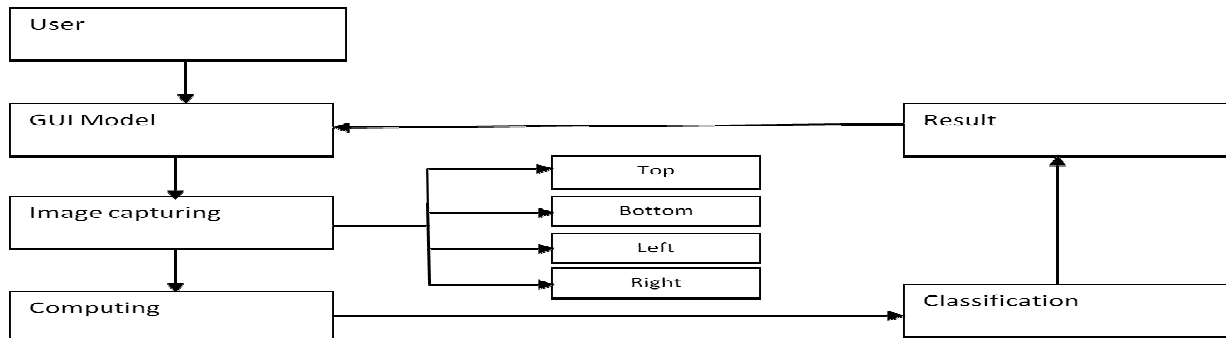


Fig 3.1. System architecture

- **User :**
User is the communicating person with the mobile phone device. Its input decides the further operation.
- **GUI Model :**
GUI module is responsible for how the user interacts with the system.
- **Image Capturing :**
Here the user captures 4 different images of the apple required for effective grading process.
- **Computing:**
User enters the weight of apple which helps in classifying the apple properly
- **Classification/Grading :**
After the comparison, the captured image will be classified into three categories i.e. average, moderate, good.
- **Result :**
Finally the classification result will be displayed to the user.

IV. SIMULATION AND RESULTS

A. ALGORITHM FOR PHASE 1- IMAGE CAPTURING

1. Start : Capture the image to be processed
2. Input: Captured image
3. Verification : Accept Image, check whether the image captured is proper or not
4. Validation : View the image that is captured
5. Stop.

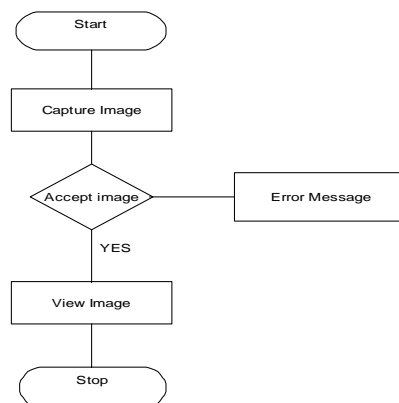


Figure 4.1 Flow diagram-Phase 1

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B. ALGORITHM FOR PHASE 2- COMPARISON

1. Start
2. Enter the manually the weight of apple.
3. Computing: Once the image and weight is entered ,the average defect percentage of apples is calculated and then the classification is done
4. Classification: A classifier is designed which helps in classifying the image of apples by considering entered weight and average defect percentage. Finally, result is displayed.
5. Result: Final result is obtained and image is classified into one of the 3 categories.

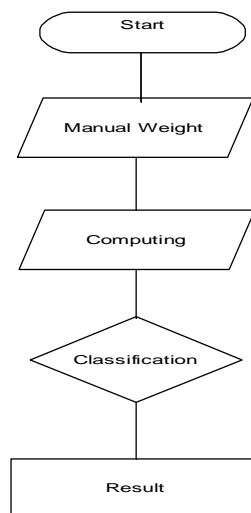


Figure 4.2 Flow Diagram-Phase 2

C. ALGORITHM DESIGN FOR PHASE 3- CLASSIFICATION

1. Computing: Once the classifier classifies, the apple in categorized into any one of the classes depending upon entered weight and average defect percentage of images of apples for all 4 images.
2. Classification: The classes are average, good, moderate and if any of the images doesn't fit into any of these classes then that image is discarded.

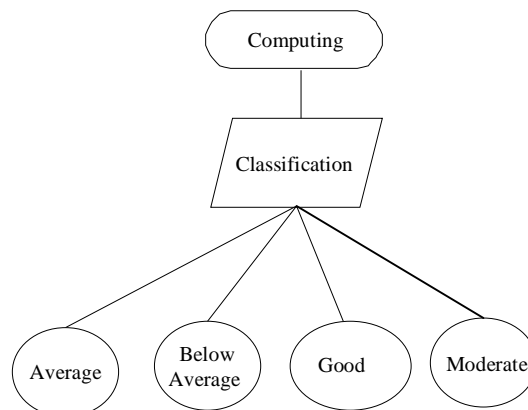


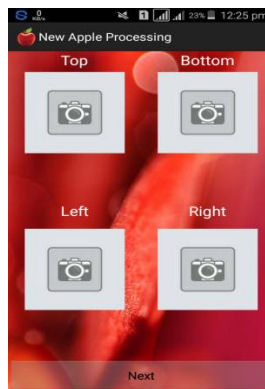
Figure 4.3 Flow Diagram-Phase 3

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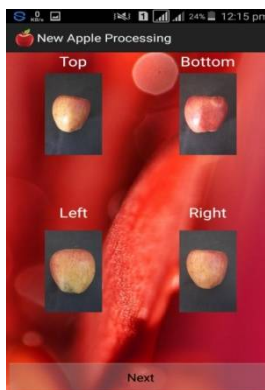
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The Snapshot (a) shows the capturing of images before the activity starts. The images of apple are captured from four different angles top, bottom, and left, right. Capture the image to be processed then accept image and check whether the image captured is proper or not if yes the click on next button at the bottom of the screen if not the cancel and re-click the images and repeat the same.



(a)

The Snapshot (b) shows the images after capturing. View the image that is captured. As the figure (b) shows proper and crystal clear images clicked by the phone user can then proceed further with the process by clicking on next button provided at the bottom of the screen.



(b)

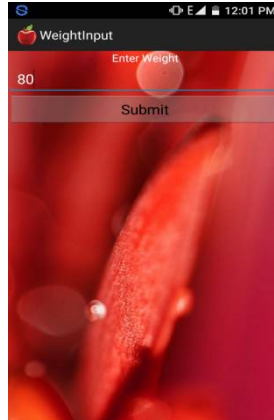
The Snapshot (c) shows the Weight Entering Activity. In this user has to add the weight of the apple manually. As per the research and statistics for standard weight of a particular species of apple the ideal number can be considered to be 70-80 grams. In this case it is considered to be 75-80 grams. After entering the weight the user has to click on submit button to proceed further.

Note: This is an approximation, sometimes the actual quantity may vary depending upon how good the fruit looks and weighs.

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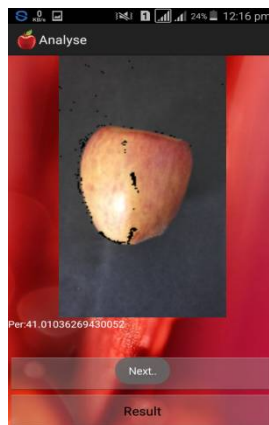
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(c)

The Snapshot (d) shows the defect percentage in the image captured. This activity shows the areas where the apple is defective. During this activity the clustering algorithm which is used for effective grading is executed, the main constraint for this is the non-red coloured areas present on the outer skin of the apple like more of brown, this is done by adding pixel value and secondary constraints are apple's images and its weight in grams. The defect percentage for individual images is shown and then user has to click on next option.



(d)

The result i.e. Snapshot (e) activity consists of final class of the apple to which it belongs, weight of the apple, average defect percentage. The grading process is complete here and various details are displayed on the screen as shown in the figure (e). The user now can know to which the grade or class the apple belongs, the categorization is done and accordingly now the user can pay for the apple depending upon its grading class.

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(e)

V. ADVANTAGES

- Can be used by any agricultural firm who is a major dealer of apples.
- Customers can use it in order pay correct price for the apples which are graded into categories mentioned.
- The application has optimum memory storage requirements, gives accurate results after the grading process.
- No special training for deployment.

VI. CONCLUSION

In the conventional method of manually sorting the apple, there is a lot of time involved. Also there is less probability about the proper grading of apple. However if the “Android Based Application for Quality analysis of apple” is used the result which is generated based on weight and average defect percentage, which will be more reliable.

VII. FUTURE SCOPE

“Android based application for Fruit quality analysis” can be extended and modified so that it can be installed on a hardware device which will grade a bulk of apples into different classes.

Most important future scope is making the application dynamic and using telecommunication concept along with database for storage of grading results either of a single fruit or of several seasonal fruits. This will involve storing the grading results of the fruits from several fruit shops, fruit markets, updating these values and grades in the database and then communicating the same to other people using GSM module of telecommunications. This way the people will not have to physically visit each and every shop to compare the quality of fruits; rather they will have the results available at the tip of their finger.

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