



PROPOSED MOBILE RICE GRAIN ANALYZER DEVICE BASED ON DIGITAL IMAGE PROCESSING WITH RELATED HARDWARE AND SOFTWARE SPECIFICATIONS

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Abstract: The aim of this paper is to suggest mobile device for measuring quality parameters of Indian Basmati Rice using image processing techniques. With the help of this device, a automated system composed of hardware and software can be made to avoid the human inspection and related drawbacks. Convenient software tools compatible with required hardware setup can be selected. Analysis and Classification of rice is done visually and manually by human inspectors. The decisions taken by human inspectors may be affected by external factors like tiredness, bias, revenge or human psychological limitations. We can overcome this by using image processing techniques. Mobile Grain Analyzer equipped with Digital Image processing techniques can classify the rice grain with speed and accuracy. Here we discuss the hardware configuration and software tools required for analysis of rice grains and how device can be used to measure, record, document and communicate the quality parameters of rice grain.

Keywords: Grain Analyzer, Microsoft Surface Pro, Aforge.net Framework, Grain Parameters, L/B Ratio.

I. INTRODUCTION

With the advancement in computer technologies, digital image processing applications has been increasingly used for analysis of quality of food material. Rice is the most important food crop of developing world. More than 900 million of the world's people depend on rice as producers or consumers. Automated machine based inspection using software system is more speedy, accurate, convenient, harmless and non-destructive in comparison with traditional methods. A device can be developed which is a combination of hardware and software. Indian basmati rice can be analysed and classified based on the parameters like length, width, length to width ratio, chalkiness value, broken/fragment grains and damaged/discooured grains. We can develop a device to measure all such parameters which analyse the quality of rice grain by comparing with given standards. There are many researches which applied machine vision to estimate rice appearance quality inspection. Yan, Chen and Guan et al. (2009) have discussed inspection of quality of rice grain appearance using machine vision. Wan et al. (2002) proposed an automatic inspection machine based on image-processing for sorting of rice grains into sound, cracked, chalky, immature, dead, broken, damaged and off-type categories. Guzman et al. (2008) used Artificial Neural Networks. Guzman and Peralta et al. (2008) suggested Machine Vision Based Classification of Philippine Rice Grains, which represents the classification accuracies of the sizes, shapes, and varietal types of fifty two rice popularly grown in the Philippines using multilayer neural networks. Their system is more effective when compared to human inspection method.

II. CURRENT METHODS AND THEIR LIMITATIONS

Very first stage in digital image processing applications is to capture high quality image of the objects which can serve as inputs to the digital image processing software tools. Current methods employs the use of digital cameras or scanners to acquire images. Captured images are then transferred to computing devices where image processing softwares can perform the parameter measurement and analysis.

Problem with these methods is that image capturing devices do not have computing power and computing devices do not have high quality image capturing ability. Another problem is that such system setups can not be used as mobile devices on the way, where at any place and in any environment, rice parameter measurement can be performed, report can be generated and communicated.

III. PROPOSED SETUP

Here we want to propose a device which have the capacity of accommodating high end software tools required for image processing and also have features of high quality image capturing. Device should be light weight, compact in size and should be easy to operate.

A. HARDWARE CONFIGURATION

We propose use of Microsoft surface pro, which is compact in size and can be used with or without keypad and also having very good image capturing ability. Following is the list of specifications which are relevant with our proposed device.

Operating System : Windows 8 Pro.

Size 10.81 x 6.81 x 0.53in

Storage: 128 GB

Display: 10.6" Full HD Display
1920x1080 pixels
16:9 (widescreen)
10-point multi-touch

Input: Pen and Keyboard

CPU: 3rd Gen¹ Intel® Core™ i5 Processor with Intel HD Graphics 4000
4GB RAM—Dual Channel Memory

Wireless: Wi-Fi (802.11a/b/g/n)
Bluetooth 4.0 Low Energy technology

Battery: 42 W-h

Camera: Two 720p HD, front and rear facing with True Color

Ports: Full-size USB 3.0
microSDXC card slot
Headset jack
Mini DisplayPort

Sensors: Ambient light sensor
Accelerometer
Gyroscope
Compass

Power Supply: 48W power supply

Applications Included: Windows Mail and Messaging,
SkyDrive,
Internet Explorer 10.

B. SOFTWARE TOOLS

We propose the use of Aforge.Net Image Processing library. Aforge.net is an open source C# framework designed for developers and researchers in the fields of Computer Vision, Artificial Intelligence, Image Processing, Neural Networks, Genetic Algorithms, Fuzzy Logic, Machine Learning and Robotics. The framework is comprised by the following set of Libraries and sample applications.

Aforge.Imaging
Aforge.Vision
Aforge.Video
Aforge.Neuro
Aforge.Genetic
Aforge.Fuzzy
Aforge.Robotics
Aforge.MachineLearning

Aforge.Net is a C# based framework . So we need Dot Net Studio and Aforge.net image processing library.

IV. GRAIN PARAMETERS TO BE MEASURED

Using a photographic enlarger, we measure the dimensions to obtain the **average length and width ratio** of the basmati grains. Following equation is used:

$$L/B \text{ ratio} = \frac{\text{Average length of rice,mm}}{\text{Average breadth of rice,mm}}$$

Percentages of following parameters are obtained by counting the number of parameterized rice grains per 100

rice grains by common equation.

- **Damaged, discolored grains** include rice kernels, broken, fragments of whole that are internally damaged or discolored, materially affecting the quality.
- **Chalky grains** mean the grains at least half of which are milky white in color and brittle in nature.
- **Broken and fragments** includes pieces of rice kernels which are less than three fourth of a whole kernel.
- **Foreign matter** includes dust, stones, lumps of earth, chaff, stems or straw and any other impurity.
- **Other grains** include those which are not rice grain.
- **Other varieties** means varieties of rice other than those notified as Basmati.
- **Under milled grain** means grain whose bran portion is not completely removed during polishing or which has substantial bran streaks left on it.
- **Paddy or rough rice** is similar term for paddy, or rice retaining its husk after threshing.
- **Green grains** means kernels, whole or broken, which are greenish in color.

$$\text{Max. (parameter) grain \%} = \frac{\text{Number of (parameter) grains}}{100 \text{ grains}} \times 100$$

- **Elongation ratio (ER)** means the ratio of the length of cooked rice to that of uncooked rice which measures the expansion length upon cooking. This can be obtained as :

$$\text{Elongation ratio} = \frac{\text{Length of cooked rice, mm}}{\text{Length of uncooked rice, mm}}$$

IV. ADVANTAGES OF PROPOSED DEVICE

Following are key advantages, which makes this device different from the current trends and practices.

A. EASY HANDELLING

Proposed device is very light weight and can be applied for mobile use. Furthermore as it is battery operated, external power supply for operation is not required.

B. COST EFFECTIVE

Proposed device (Microsoft Surface Pro) costs nearly 50000/-Rs. And cost of Dot Net Studio Software and development of Grain Analyzer Software inclusively costs nearly 20000/-Rs. Total cost of proposed device remains nearly 70000/-Rs. And can be considered very affordable keeping in mind repetitive use and flexibility.

C. CONNECTIVITY

This proposed device provides Bluetooth, WiFi, and USB 3.0 connectivity options. For internet connectivity WiFi and USB dongle can be used.

D. REPORT GENERATION

Based on the different parameter measurement report is generated as a summary. This report can be used for quality comparison and cost determination. Furthermore report can be printed if printer is available using cable or using Bluetooth connectivity.

E. INSTANT REMOTE ACCESS

With the internet connectivity, report can be send any ware to the desired recipients and input image of rice grain which required to be processed can also be acquired from remote location.

V. CONCLUSION

Digital Image Processing based Rice Grain Analyzer can be used for parameter measurement and report generation in a flexible way. Easy handling ability of device makes it suitable for on the spot inspection of rice grains. So using this device enables you to measure the quality parameter of rice grain any ware.

VI. FUTURE SCOPE

Expansion on this device can be customized hardware based on the requirements of trading points in rice

marketing industries in the future. Software can also be extended to be a part of web portal, where each entity of business can upload image of rice grain, can process and download the report generated. Customized commercial client server software application can also be designed.

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