Grain Quality Detection by using Image Processing for public distribution

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***Abstract*— In our life food is necessary for nourishment and sustenance. There are some additional impurities present in the food such as stones, damaged seeds, broken granules which affects the composition and the quality of food. Determining the quality of grains is a big challenge. Wheat and rice are used by most of the population across the world. In this paper, we have proposed a system that determines the quality of food. Initially, the grain samples run on the conveyor belt and then random images of grains are captured by the camera. The image processing algorithm is applied on the grain samples through MATLAB. The classification has been done according to colour, shape and size. It results good, bad and medium quality by using Neural Network (NN) classifier. The final output is displayed on the LCD also the message will be sent to higher authority through GSM module. This system can be implemented in food industries at later stage for grading purpose which will ma the task of classification of grains simpler for the public.**

Keywords—Image Processing, Grain Quality, Neural Network.

I. INTRODUCTION

Food is a basic need of life. Without food no one can survive. So, it is a basic need to have food daily which should be of good quality. As India is a highest producer of wheat and rice (agriculture) across the globe, people don't get good quality of food. The quality of food is an important factor for proper nourishment and today's market should be free of adulterated food grains. These grains consist of several impurities like stones, damaged seeds, broken granules etc. The addition of impurities in food affects the composition and quality of food. There is no convenient method to identify these inferior quality grains in the market. Human perception based on visual inspection has long been recognized as a guide to quality assessment but the results are not accurate and reliable.

To overcome this problem, image processing has been used to classify food grains according to its quality. The challenges are:

- Quality issue
- Automation in quality assessment

In this paper, for grain quality assessment we have used wheat and rice grains. Our system divides food in three classes i.e. good, bad and medium according to training.

II. STATE OF ART

The food industry has been growing at a very fast pace and so is the requirement for a good and accurate method to access the quality of food grains at the very initial stage. Many researches are going on from a long time to incorporate proper measures for this purpose.

Qing Yao, Jianhua Chen, Zexin Guan, Chengxiao Sun, Zhiwei Zhu have been implemented an automatic system which relies on machine vision. This is used for checking the rice appearance quality, including rice chalkiness and shape. In their system, they used 2 methods for evaluating the shape of rice and for inspecting chalkiness of rice namely, minimum rectangular method and improved multi-threshold method [1]. Yong Wu and Yi Pan have been proposed cereal grain size measurement method based on image processing technology. Their method measures the grain size parameters including grain number, area, size, roundness and size distribution. Their method is used to reduce the error in measurement of grain image and also increasing the degree of automation of grain size measurement technique [2]. Megha R. Siddagangappa, A. H. Kulkarni have been introduced automated system which is used for grain type identification and analysis of grain quality. This system has been uses the Probabilistic Neural Network classifier. The color and geometrical features are used as attributes for classification [3]. Image processing techniques provide a way to grade the food grains. In this paper a technique for quality assessment of pulses grains is presented by measuring the pixel area which improves the accuracy of quality assessment of food grains [4]. R. Kiruthika, S. Muruganand, Azha Periasamy have been worked on digital imaging approach for rice grains. In which the proposed system has been investigated different types of characteristics to identify the rice varieties. The system tests Two different rice varieties. They have been included existing standards for rice length, area and aspect ratio features of rice. Successfully it has been shown the effectiveness of compactness as its features. When the data base of this work can recognize the rice, which has been trained the data in number of time; and hence it has been identified [5]. Rubi Kambo and Amit Yerpude have been worked on basmati rice. The system has been given the principle component analysis approach for

classification of different varieties of basmati rice. They have used morphological features like area, major axis length, minor axis length, eccentricity and perimeter for analysis of grain samples [6].In this paper, two data fusion approaches have been used to categorize the grain samples into three groups. Using image analysis, the first approach fuses results obtained on the basis of colour and shape characteristics while the second approach fuses shape data, colour and surface texture data obtained by spectra analysis [7]. In the work by D. M. Hobson, R. M. Carter, Y. Yan, identification of rice varieties based on their characteristics has been done using a digital imaging approach. Eight different common rice varieties were used in tests for defining features which include existing standards for grain length and aspect ratio features, and also shows the effectiveness of compactness as a feature. In order to distinguish brown and milled rice in grey scale images, a novel texture feature is also shown. An inexpensive imaging system has been used to employee these techniques that is nonintrusive and non-destructive. Substantial work for identifying and classifying different grain varieties has been reported [8]. Zayas et al. image analysis has been used to discriminate between wheat and non-wheat components in a grain sample. Two methods have been presented, multivariate discriminate and a structural prototype method for pattern recognition [9]. N.S Visen et al. a research has been done to develop and optimize a technique to discriminate various types of grains by extracting the morphological, texture, and color based features using images of single kernels and compare the classification accuracies using back propagation and specialist probabilistic neural network classifiers[10]. The research by L. A. I. Pabamalie, H. L. Premaratne they provide better approach for rice quality identification by using neural network and image processing. In this research, for quality classification they used a back propagation neural network with two hidden layers. For discriminate analysis thirty-one texture and color features that have been extracted from rice images. Tests show accuracy in between 94% to 68% for the four grades. This research has been done to identify the relevant quality category for a given rice sample and it was based on three parameters that are used to measure the quality of rice sample [11]. S. Borah, M. Bhuyan and H Saikia, work on color detection in tea fermentation using an artificial neural network. They have attempted for testing the color with H (Hue), S (Saturation) and I (Intensity) color model using digital camera [12].

III. PROPOSED SYSTEM

Figure 1 shows the block diagram of proposed system; this system has its utilization at food industry for grading purpose. The process starts before the customer encounters the food grains. It's an initial process in food industries. Henceforth, the cost is decided for each type of grain. In this system, images of wheat and rice samples are taken by a camera and then it's given to the image processing unit. All these food grains are run along a conveyor belt and the images are captured randomly of different samples. The processing is done in MATLAB R2016a.This captured images processed in MATLAB grain image output is then displayed on the LCD in the form of good, medium or bad quality of grains. If the grain quality is found to be bad, the buzzer rings. Also the message will be sent through GSM module to the higher authorities. We are working on the colour, shape and size features of the food grains (wheat and rice) in order to grade them for quality.

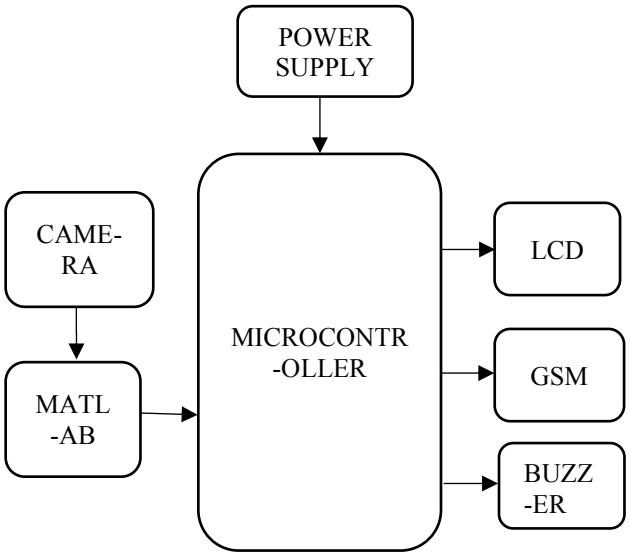


Fig.1: System block diagram

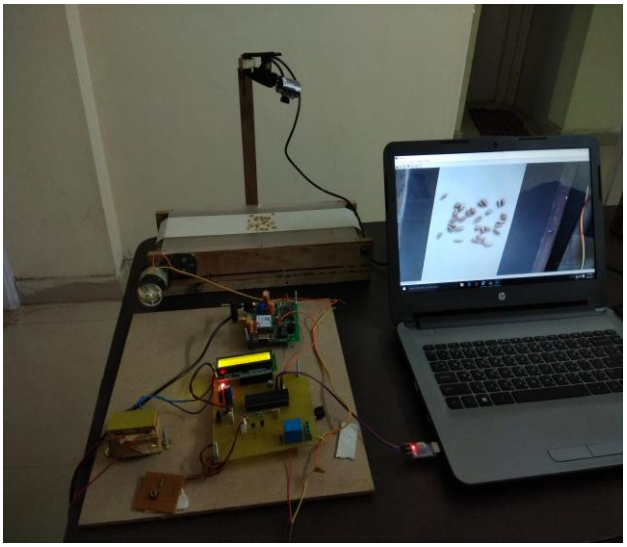
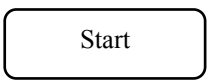


Fig.2: Hardware setup

A. System Flow



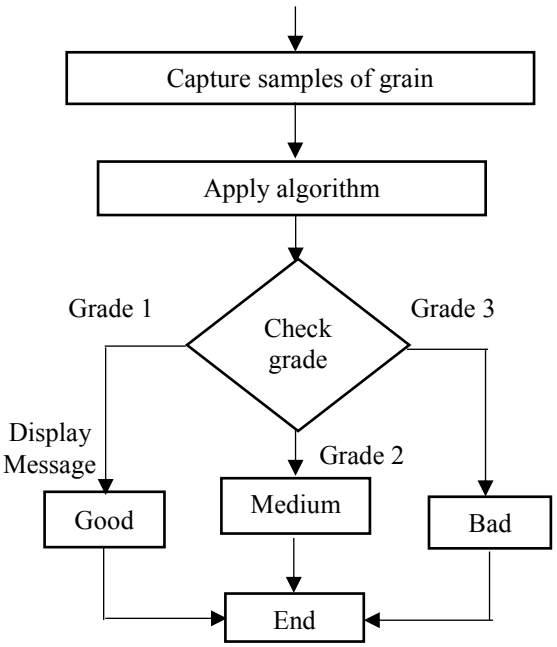


Fig.3: Flowchart of System

B. Algorithm

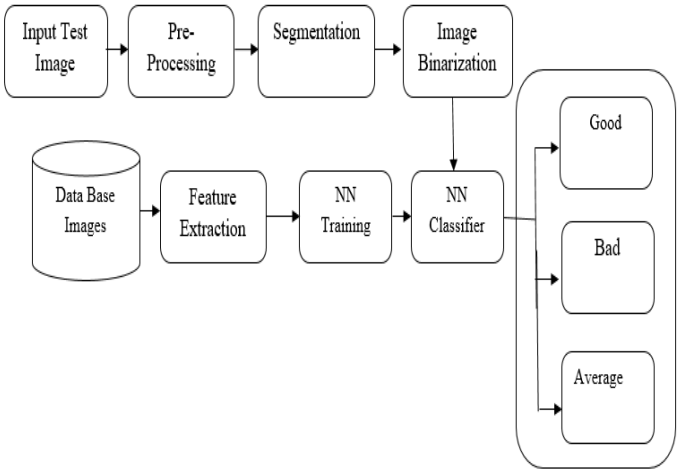


Fig.4: Algorithm steps

1. Image Acquisition (input test image): Image of grain sample is taken by camera. The camera is fitted at fixed distance above from grain sample on conveyer belt. So, here we get our input image.

2. Pre-processing: In pre-processing first we convert RGB to grey image. And then we place Low pass filter so that the pixel noise can be removed.

3. Segmentation: In this step, the captured image is resized. The background is eliminated and foreground is extracted which is the region of interest. And then the thresholding is done. Thresholding is used to separate the region in an image with respect to the object, which is to be analyzed and this is based on the variation of intensity between the object pixel and background pixel.

4. Image binarization: binarization of an image on the basis of its contrast levels.

5. Database image: collecting image samples.

6. Feature extraction: In this step, qualitative information about the object is extracted from image. The geometrical features of grain are extracted from sample image. These features are:
   a. Area
   b. Major axis length
   c. Minor axis length
   d. Perimeter.

7. NN Training/Classifier: NN classifier is first used to train the collective data. And then it classifies the images according to features. In this case the classes are good, bad, medium.

IV. RESULTS AND DISCUSSION

fig.5. Shows the a 'grain quality detection' message when system is initialized.

Fig.5: Initialization of system

Fig. 6. Shows the input image of wheat sample.

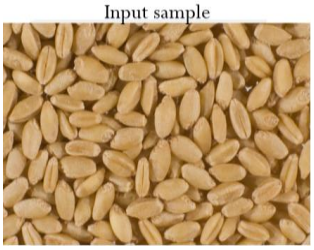


Fig.6: Input wheat sample -1

Once the image is captured by a camera and is given as an input, it is processed in MATLAB and image processing algorithm is applied on it giving the results according to the trained database.

Fig.7: display of results

Fig 8 shows the output in MATLAB (command window)

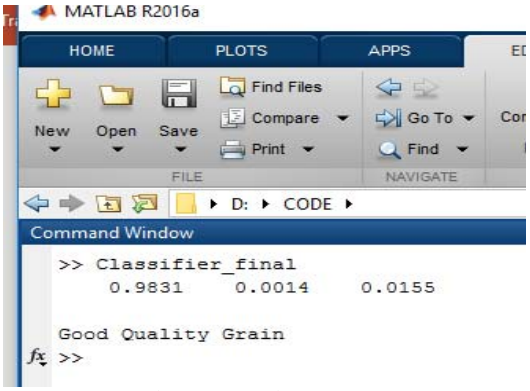


Fig.8: Output in MATLAB

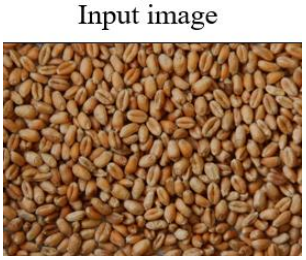


Fig.9: Input wheat sample-2

The similar algorithm is applied to next samples giving the results according to training.

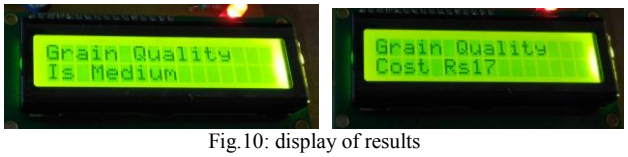


Fig.10: display of results

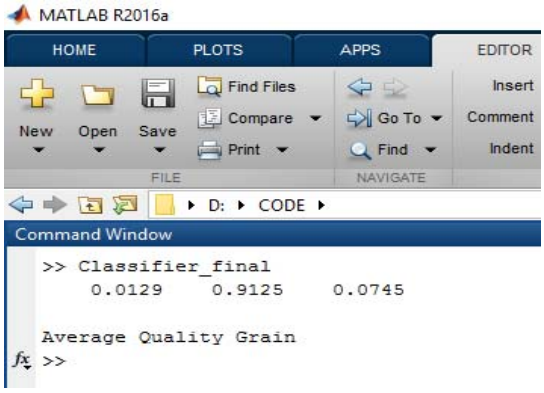


Fig.11: Output in MATLAB

Fig.12: Input wheat sample-3

Fig.13: display of results

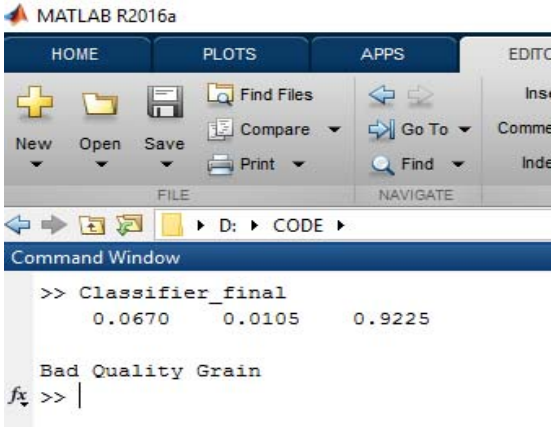


Fig.14: Output in MATLAB

Fig.15 shows the message received from the GSM module after detecting the quality of the grains.

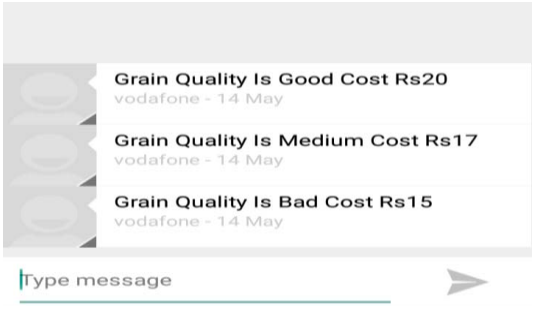


Fig.15: GSM module output

Similar process will be carried out to know the quality and cost of rice.

V. CONCLUSION

The proposed system has been worked on wheat and rice samples to determine the quality. The analysis is based on color, shape and size. The database of hundred images are trained for classification. The classification has been done with the help of NN classifier. It results good, bad and medium quality. This system is fully automated in food industry and gives cost effective solution. Also it is relaxed, reliable and less time consuming. The results found are more accurate.

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