Application of Image Processing for Automatic Cleaning of Rice

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Abstract -**A faster, automatic, precise system is developed for the cleaning of rice. The system acquires images of rice using linear optical sensor array. Images are processed and analyzed. Sensor detects any color defect & instructs the ejectors fitted in the system to open the nozzle. The nozzle is connected with valves containing compressed air. This air is used to throw the color defects like stones, earth granules, chalky, yellow, immature grains etc. from the input rice. Rice cleaning system can be used in rice mills during the processing of rice and food industry. The accuracy and speed of the system is very high than the conventional methods which causes errors due to human being.**

I. INTRODUCTION

Today's world is the world of technology and science. Due to automation, life has become fast and luxurious. Rice is one of the most common sources of food consumed in the world. With the improving living standards of human being, huge amount of rice with higher quality than before is required today. The quality of rice is based on a variety of properties such as cooking texture, color (whiteness or chalkiness), size, shape and the number of broken rice kernels, stones, earth granules, yellow, immature grains.

Rice quality inspection by humans (relying upon naked eyes) is neither objective nor efficient. Error increases sometimes due to inexperience or the inspection may be deliberately shifted out of sympathy for the producers. Traditional mechanical process could only eliminate tiny particles that are smaller than rice, such as crude bran. This kind of purely mechanical method is useless in recognizing and separating rice with different impurity but the same size. Most of the rice sorting machines available on the market are still based on the technologies of the 20th century, such as centralized control, and programmable logic device. Major shortcomings of such systems are 1) very simple functions, limited software adaptability whereas high design complexity 2) signal attenuation resulting from long distance transmission of the optical sensors output signal connected to the controller by long wire.

MVS was developed by Wan, Lin and Chiou to sort rice with an accuracy ranging from 87% to 90%.These methods use a CCD video camera with illumination source for image acquisition and a PC with frame grabber and specially designed software for image processing and analysis. For on line measurement a transport system is used to position the rice kernels below the camera and for sorting a discharging device is used to collect the classified kernels in different containers. MVS is relative expensive, influenced by external light conditions and needs an experienced person to setup the system.

In the conventional rice sorter, image of fallen rice from a shoot is captured, and then rice color-stone is compared with some threshold value. If the rice color-stone is below the threshold value, the rice is rejected as damaged rice. For this conventional rice sorter, when percentage of paddy in polished rice exceeds 1%, it is difficult to exclude all paddies. Furthermore if rice flow exceeds a few thousands [kgh], the recognition percentage is below 90% and recognition ability is not always guaranteed. While small flow of rice guarantees recognition ability, this matter leads a low efficiency for rice sorting. So the efficient system needs to be developed.

II.SYSTEM GROSS STRUCTURE

This system is used to find the stones or dust and separate them from rice, ultimately makes the rice clean, automatically. As shown in fig 1, the system consists of electromagnetic vibrator which allows falling the rice and stones mixture present in feeding bucket from conveyor belt one at a time. After the grains of rice are loaded onto a conveyor, they are illuminated and then imaged. After the line scan optical sensor detects the grains of rice, the captured images are processed on-board by the ARM controller. Typically, image-processing algorithms determine the gray-scale level of objects within an image, and then threshold algorithms are used to set the limits of what is sorted. As the rice mixtures are being scanned, the gray-scale

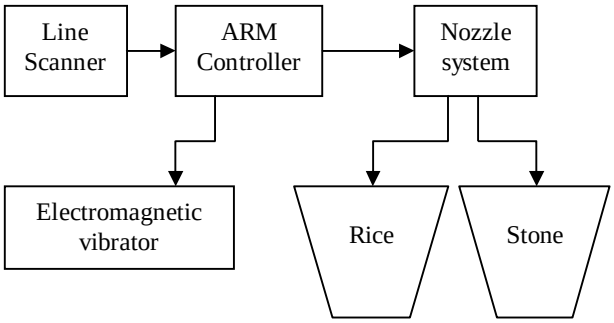

Fig1: Block diagram of rice cleaning machine

data will be compared to a preset threshold limit value. In an 8-bit system, each pixel will represent pure white at 0 and 255

is pure black. Sorting will simply assign a pass or fail based upon the pixel value and the preset threshold limit. After the sorting algorithms determine which grains of rice are passed or failed the camera triggers a number of air-jets. The air-jets push each rejected grain of rice into a separate bin.

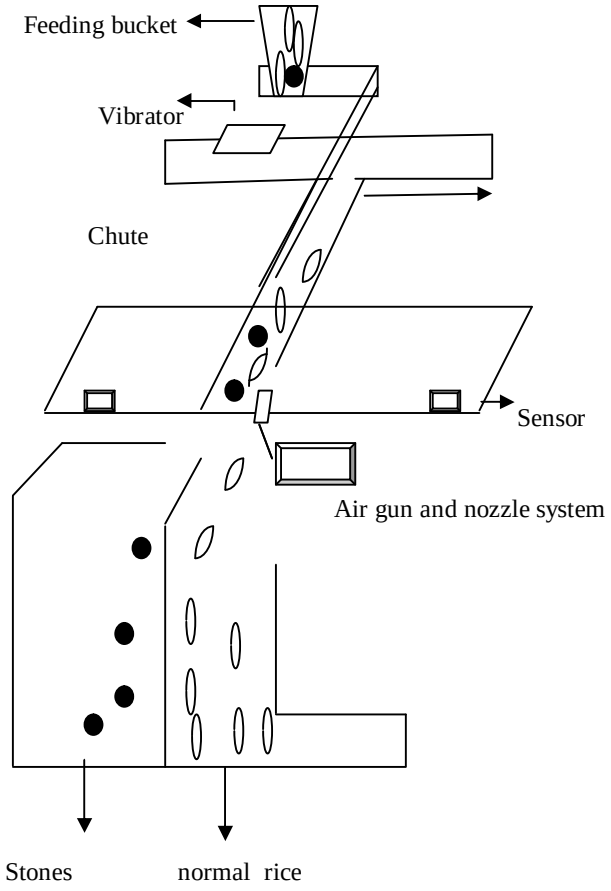

Fig 2: structure of rice cleaning machine

Fig 2 shows the working of the rice cleaning system.

III. METHODOLOGY

Mixture of rice, stones, yellow grains, immature grain was allowed to spread on electromagnetic vibrator so that rice flow will be smooth. Fig 3 shows the flow of cleaning procedure.

A. Scanning the sample rice mixture

Image of the rice kernels was acquired by a flatbed scanner used in the reflective mode, 8-bit grayscale and a resolution of 300 dpi without contrast stretching (full histogram range of 0-255) or other corrections. The FBS was used with a sample holder, which was made of transparency and a black sheet joined together at one end. A dull black sheet used to avoid the effects of reflection. A transparent sheet was used so that the glass of the flatbed scanner does not get damaged due to continuous use while placing the rice kernels.

Sequence of operation of sensor TSL 3301

i) **Pixel reset (RESET)**: sets all the integrators to zero
ii) **Start of integration (STARTInt):** Releases the integrators from the reset state and defines the beginning of the integration period.
iii) Sampling of integrators (SAMPLEInt): Ends the integration period and stores the charge accumulated in each pixel in a sample and hold circuit.
iv) Pixel output (READPixel): Reading the pixel causes the sampled value of each pixel to be converted to 8 bit digital format and output on the SDOUT pin.

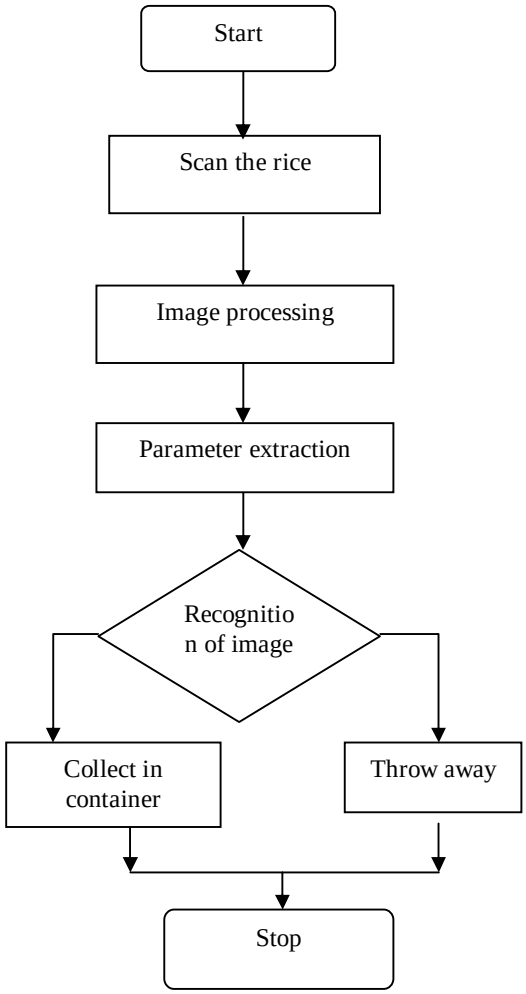

Fig 3: Flow chart of the sorting procedure

B. Image processing

i) Smoothing

Images were preprocessed using a smoothing filter that included operations which can enhance and smooth images, accentuating image edges and remove noise from an image.

Most of these operations compute results based on weighted sum of a pixel value and its neighbors values.

ii) Binarization

A binarizing operation reduced the image to two grayscale values, 0 and 1. In general, these values are zero and the maximum value (for 8 bit image it is 255) in the image. Image data is converted to binary data by threshold value.

If contrast of pixel is over threshold value,"1" is assigned to the pixel.

If contrast of pixel is below threshold value,"0" is assigned to the pixel.

C. Parameter extraction

A histogram is the intensity distribution of pixel values in an image and is generated by counting the number of times pixel intensity occurs. This application is useful for the determination of color and chalkiness. In particular, it is useful to select a threshold level while binarizing an image and to change the image intensity distribution while trying to increase the image contrast. Values of various parameters of the sample kernel were extracted. Parameter or feature extraction is required for classification .data obtained from histogram is used for the determination of color of rice and other impurities. Color parameter of the rice is considered.

D. Recognition of rice

Intensity of white color is more than threshold for the rice image and is less for the image other than rice such as stone or yellow grains. High performance P89LPC938 ARM controller is used, which gives signals to nozzle system. Nozzle system collects the white rice grains in a container and throws away the stones or yellow grains into the other container.

IV. RESULTS AND DISCUSSION

Input rice Clean rice Stone and other impurities

Fig 4: system overview [1]

Experiments have been conducted to verify the feasibility of the developed system. Mixture of rice and stone was taken with 5 of stone 10%, 30%, 50%.the system sorted the rice with accuracy.

V. CONCLUSION

A faster, automatic, precise system for the cleaning of rice grains is designed. Image processing techniques are used for the implementation of the system. The system can replace the mechanical, conventional methods of rice cleaning with high speed and accuracy. We have constructed the prototype system with the use of linear sensor array, ARM controller P89LPC938.We have considered real time calculation. Each rice grain requires 30us for complete processing.

REFERENCES

1.Wu Zhihong,Zhu Yuan, Chen Guoqiang, Shi Xinying, Feng Jiayun, "Research and Development of Rice Color Sorter ",International Conference on Measuring Technology and Mechatronics Automation,2009.
2. Bhupinder Verma,"Image Processing Techniques for Grading & Classification of Rice", International conference on computer & communication technology, ICCC 2010.
3.Fumiaki Takeda, Hisaya Uchida,Take Tsuzuki, Hiroshi Kadota and Satoshi Shimanowhi, "A Proposal of Grading System for fallen rice using Neural Network" ,IEEE transaction on neural network,2002.
4. Liu Guang-rong, "Rice Color Inspection Based on Image Processing Technique",International Conference on Advances in Energy Engineering, 2010.
5. Frederick E. Sistler, "Grading Agrictural products with machine vision", International Workshop on Intelligent Robots and Systems IROS '90.
6. Mingyin Yao, Muhua Liu, Huadong Zheng, "Exterior Quality Inspection of Rice Based on Computer Vision".
7. D. M. Hobson, R. M. Carter, Y. Yan, "Characterization and Identification of Rice Grains through Digital Image Analysis", Instrumentation and Measurement
Technology Conference - IMTC 2007
Warsaw, Poland, May
8. Dai Xiaopeng , Liang yong, "Research on the Rice Chalkiness Measurement Based on the Image Processing
Technique".