Development of scratch detecting algorithm for ITO coated glass Using image processing technique

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Abstract

This research describes a image-processing technique for the scratch detecting algorithm for ITO coated glass. We use the modified logical thresholding method for binarization of gray-scale glass image. This method is useful to the algorithm for detecting the scratch of ITO coated glass automatically without need of any prior information of manual fine-tuning of parameters.

1. Introduction

In the past, it took a long time to detect the scratch of ITO coated glass because it is manual process. But this process is very important about the quality of ITO coated glass for organic EL. Hence, the research on algorithm for detecting scratch automatically now being conducted.

We adopted the image processing techquie about the process of detecting scratch automatically. The captured image has poor quality because of variable background intensity due to non-uniform illumination, very low local contrast due to shadows in the capturing process of the image and serious signal-dependent noise and so on. It is essential to find threshold methods which can correctly keep all useful information and remove noise and background.

Although many thresholding techniques, such as global , and local thresholding algorithms, multi-thresholding methods and adaptive thresholding techniquies have been developed in the past, it is still difficult to deal with images with very low quality. Therefore, we use a thresholding method for base on adaptive logical level technique to binarize seriously degraded and poor quality gray-scaled ITO coated glass image.

The thresholded result image is a binary image which background is white and scratch is black. This usage is possible this technique at automatic inspection process in manufacturing ITO coated glass of organic EL. In this paper we report image processing algorithm to detect scrach and to enhance signal-dependent noise from ITO coated glass of organic EL.

2. Experimental

The experimental equipment consists of Optical device and Image processing Software based on PC. The specification of equipments mentioned above are listed following.

Optical Device

CCD Camera : XC-75 (Sony)

Lenz : Progressive Zoom (0.5~2X)

Illumination : Coaxial halogen lamp

Image grabber : Meteor (Matrox)

Image processing Device

Dev. Tool : Visual C++ 6.0

Computer : Celeron 1 GHz, 256MB RAM

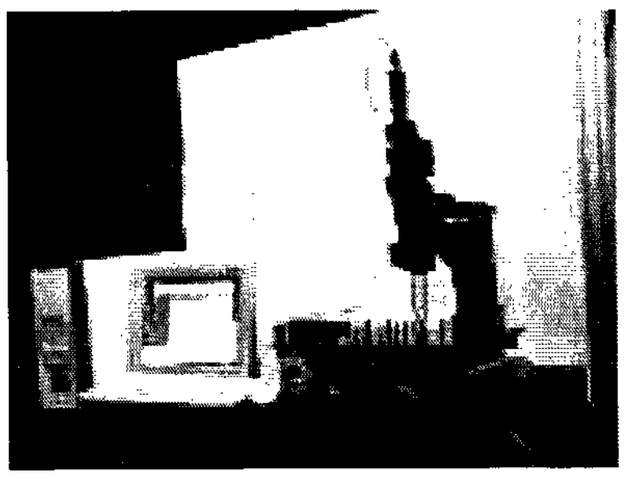

Figure 1 Experimental Equipment

The captured image of 1mm scale using the experimental equipment is below. As the result of this calibration, the resolution of captured image is 4.7 μm.

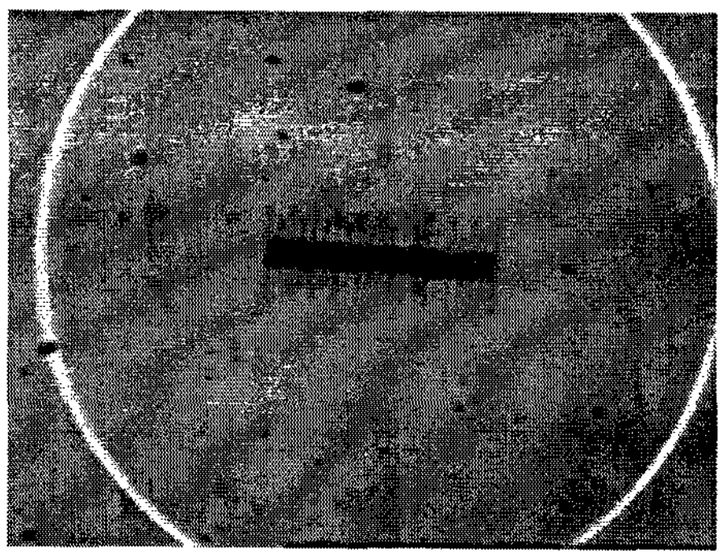

Figure 2 The Captured image of 1mm scale

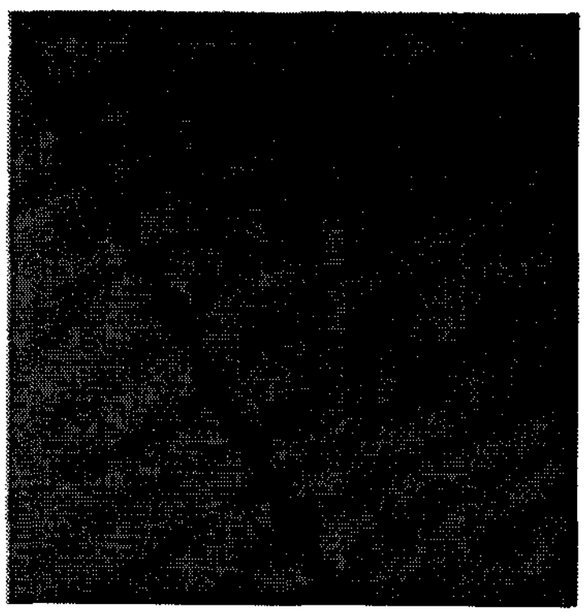

Figure 3 The typical image of scratch

Image processing software is developed using Visual C++ 6.0. It contains many image processing functions and basic signal processing functions.

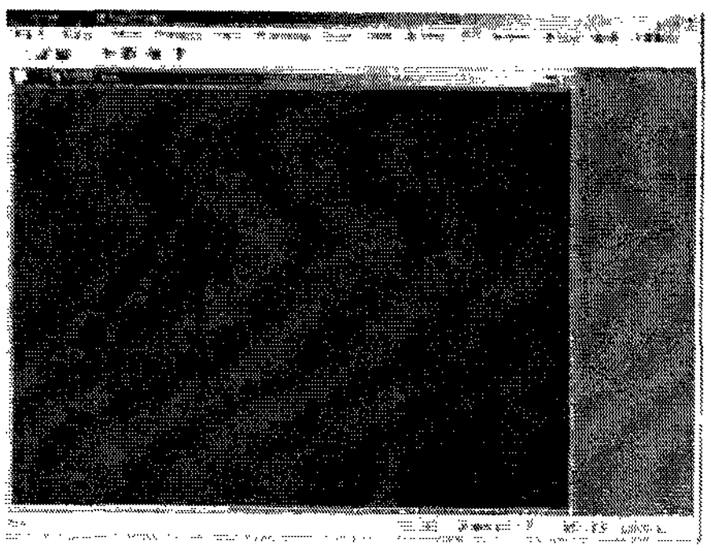

Figure 4 The developed software

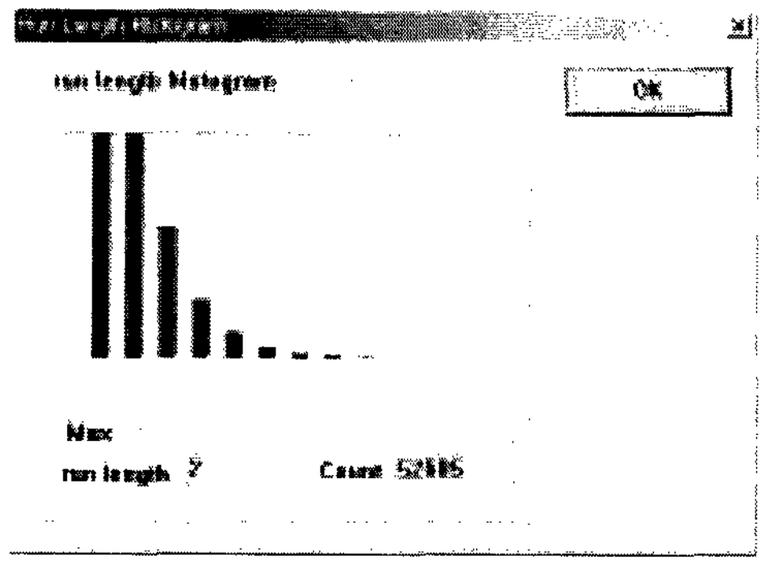

Figure 5 The run length histogram of typical scratch image

The image to be captured is processed through adaptive logical thresholding . Logical level technique proposed by Kamel and Zhao is developd on the basis of analyzing integrated function algorithm. It is base on the idea of comparing the gray level of the processed pixel or its smoothed gray level with some local averages in the neighbors about a few other neighboring pixels. Finally, the image to be thresholded is removed noise using labeling. The criterion of this noise removing method is the number of connected componets.

This process make progress adaptively and automatically as follow.

Step 1 : Calculate Run length histogram
(Glabal anlaysis)

Step 2 : Calculate Stroke width from Run length histogram (Glabal anlaysis)

Step 3 : Determine Window Size from Stroke Width (Local Analysis)

Step 4 : Calculate Threshold Value

$$T = \alpha\left(\beta_1 f_{SW} + \beta_2 ave(P)\right)$$

Step 5 : Labeling connected componet

Step 6 : Remove small size component

3. Results and discussion

Image processing system consists of CCD camera which takes photographs for ITO coated glass and image grabber which converts image signal in voltage

to that digital code. The camera used in this study was a XC-75 (sony). The grabber was Meteor(Matrox). The resolution of captured image is 4.7μm. The precision of detecting algorithm is 2~3 pixel (12~15μm).

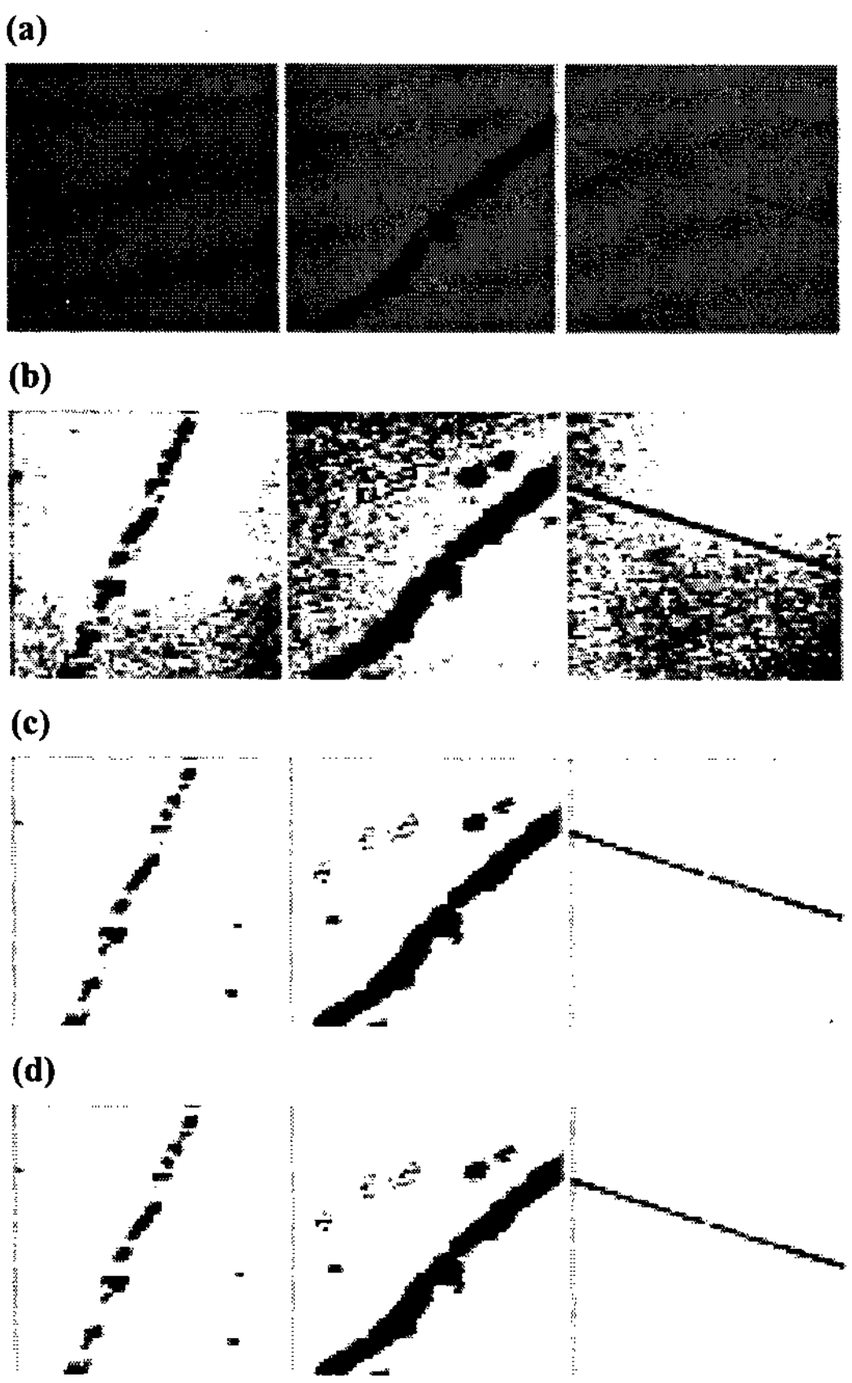

Figure 6 Result of Image processing

(a) Captured image

(b) Glabal threshold (Gray level 97)

(c) Adaptive logical threshold

(d) ALT + Noise Remove

We can acquire the image which scratch is black(Figure 6).

4. Conclusion

A modified logical thresholding method for binarization can deal with complex signal-dependent noise, variable background intensity cause by nonuniform illumination. Therefore this method can be used to detect scrach minimum size 12~15μm (3~4 pixel) and to enhance signal-dependent noise from ITO coated glass image of organic EL. In the application about the field of manufacturing process , we can use this technique at the in-line inspection process.

5. References

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