Identification of PCB Faults using Image Processing

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***Abstract*--The aim of this paper is to develop a more accurate PCB inspection system. In this method captured colored images are natural images i.e. without any pre-customized environment and hence the every time the capture images varies with lighting conditions, the distance and inclination and these issues are to be handled effectively. Most of the work in this regard just detects the location of the fault but merely little work has been carried out to identify the type of the PCB faults automatically. This paper attempts to detect two types of PCB faults effectively.**

Keywords: PCB, Fault Detection; Image Processing; DFTR;

I. INTRODUCTION

Printed circuit board (PCB) is a mechanical platform of conductive and non-conductive layers on which electronic components are electrically connected. Glass fibers and epoxy is used to form non-conductive layer of the PCB and copper, nickel, aluminum, chrome and other certain metals are used form the conductive layer of the PCB. Fabrication of PCB is a multilevel process inhibiting several multidisciplinary processes. Etching is one such process in the PCB fabrication wherein unwanted metallic portion occurring in places other than the designed pattern is removed. If the PCB defects are still present in the post-etching inspection stage PCBs are considered as the scrap and are discarded as they are unfit to be used. The notable fact is about 70% of the PCB fabrication cost is utilised for etching process [1]. Most of the inspection are done at the later stage and makes the etching process a most critical part in the PCB fabrication in terms of cost, time and scarp. In order to reduce the cost and scrap in the PCB fabrication process, the inspection is to be done at the early stage. One solution for this is to use the image processing techniques for the inspection.. Many researches have been made in this regard using image processing. But most of them deal with the images which are captured in predefined environment where the light, vertical distance between the image acquisition systems are kept constant. These systems fail to treat for natural image which don't have a non-changing ambience all the time. The previous work [2] made an attempt to identify the defects in natural PCB images and associated practical issues like

a. PCB image tilt
b. Variable distance between PCB and image acquisition device
c. Images with varying illumination scenarios

Were addressed using image processing techniques. There is need to extend the work to produce PCB inspection system which can effectively takes care almost all the faults and identifies 14 types of PCB faults without any human intervention In this work the systems detects the location of the faults but not the types of faults automatically. Here in this paper there is an attempt to treat this issue.

II. PROBLEM FORMULATION

As part of continuation to this work [2] the objective of the proposed work is:

1. To develop an accurate system which detect the 14 faults of Bare PCB Faults using Natural Images.
2. Finds the type of faults. Here two types of faults are considered for identification of the type of faults.

III. LITERATURE SURVEY

In 2015[3], the RongliLiu , Xuedong Xue and Kan Cheng carried on research on PCB detection. This method is carried out by circuit design, combination of

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software and microprocessor for inspection and testing stage. The designed system witnesses the speed and accuracy in locating PCB faults.

In 2015 [4], the Liying Yuan, XueXu proposed an algorithm of global edge detection which can obtain the whole edge using adaptive smooth filter algorithm and Canny operator. The proposed algorithm selects local area (instead of whole edge) detection method for edge extraction. Local edge detection uses distance weighted average method and k-average method to overcome the effect of outliers on clustering. The designed edge detector is found to be freer from false edges when compared with edge detection from the canny operator and Sobel operator.

In 2015 [5], the V. Saminadan, AishwaryaP ,Manimegalai M , Nivedhitha M proposed a method for a Haze removal In this method Images of outdoor scenes are usually degraded under bad weather conditions, which results in a hazy image. In this paper, two image priors, called the pixel-based dark channel prior and the pixel-based bright channel prior are used to remove haze from a hazy image. Based on the two priors with the haze imaging model, the atmospheric light is estimated via haze density analysis followed by finding the transmission map. Since the transmission map suffers from halos and block artifacts, we refine it via guided filter. The output of a guided filter is a linear transform of the guidance image. Guidance image can be the input image itself or another different image. In our case Guidance image is hazy image.

IV. PROPOSED SYTEM AND EXECUTION

The bird view of the proposed method is shown in the Figure 1.

The proposed methodology carried out by following steps

1. Take a test image
2. Resize this test image to 256x256
3. Pre-process the test image
   a) Detects the haze
   b) If the image is hazy then haze is removed
   c) This is converted into grey scale image
   d) The grey scale image is converted into binary image using Otsu's method
   e) Edge detection -If the image is hazy then canny filter is used else sobel filter used to detect the edge
   f) The Hough transform is applied to find the longest line in the test image
4. Step 1 -3 is repeated for template image
5. Difference in the angle between the longest line in test and template is gives the angle tilt between the test and template image.
6. Then test image is rotated for an amount of angle difference of longest lines.
7. Image is crop to its borders to suing histogram based technique.
8. Image subtraction is used to compare the images.
9. The faults in the template are detected
10. Detected faults are presented using blob detection

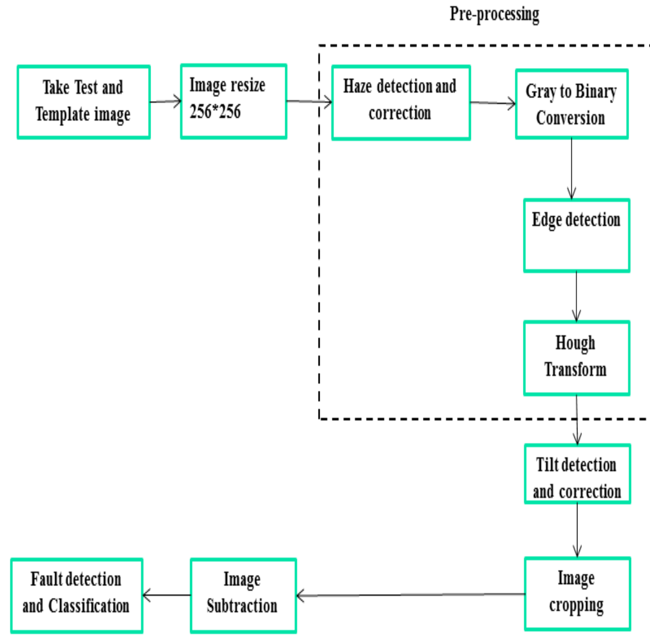

Figure 1.: Proposed Block diagram

V. IDENTIFICATION OF FAULTS

Above steps detect the location of the faults. The location of the faults is taken. Considering this as the center the window of size 100x100 is taken as the region of interest. Hence the ROI encounters the PCB faults

The two types of faults are identified as follows:

A. Cut:

- The thresholding of the ROI is done to convert the grey scale into binary form ROI. The ROI is centered at (127, 3729).
- No .of 0's and 1's are counted in each of the extracted ROI.
- The region with the cut fault has more number of 1's than the other region. Hence there great transition on the number of 1's form few number to large indicating the fault to be edge cut.
- The same can be done if the cut is vertical.

Figure 2 and Figure 3 shows the output for identification of Extra DFPR

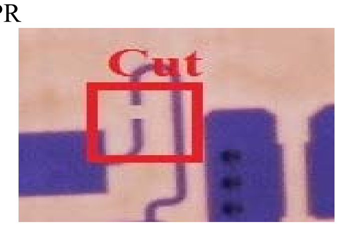

Figure 2: Output for identification of Cut

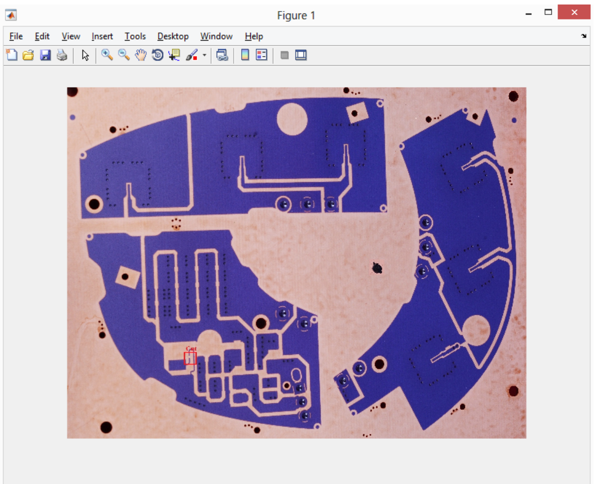

Figure 3: MATLAB Output for identification of Cut

B. *Extra DFPR.*

- The ROI is considered in the color image of the PCB. The size of ROI is maintained 50x50. The ROI is centered at (502, 1090).The pixels value in this region is more towards the darker side when compared with the area without the extra DFPR fault. This confirms the error to be extra DFPR.

  Figure 4 and Figure 5 shows the output for identification of Extra DFPR

Figure 4: Output for identification of Extra DFPR

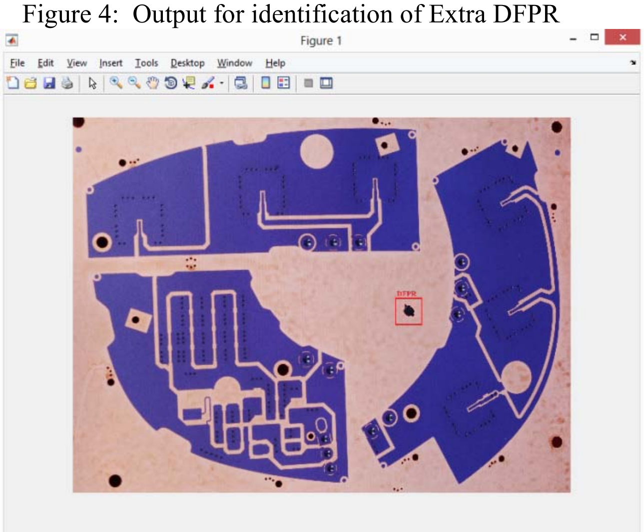

Figure 5: Matlab Output for identification of Cut

VI. CONCLUSION

The results are taken with the for 7 test images. The model showed the correct output for about 6 test image when compared with the standard image. So the current efficiency of the proposed model is about 90% in identifying the type of faults. Here we have considered only two types of PCB faults. Similar image processing techniques can be adapted for other types of faults.

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