RESEARCH ARTICLE OPEN ACCESS

Using Image Processing for Detecting Defects in Printed Circuit Board

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Abstract:

A circuit board along with its electronic components mounted on its surface forms a Printed Circuit Board. A bare standard PCB without mounted components is scanned and compared with PCB to be inspected using image processing techniques and resultant image is checked for defected regions if found. Our focus is to examine every PCB for its defects.

Keywords **— PCB defects, Standard PCB Image, Image Processing, Inspected PCB Image.**

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I. INTRODUCTION

The PCB (printed circuit board) manufacturing is becoming more and more important as the consumer electronics products, such as mobile phones, tablet PCs, automatic washing machines and so on, are indispensable for our everyday life. PCB's that are manufactured needs to be compared with master PCB to ensure that they defect free. Manual inspection was used in the existing system to detect any defects in the PCB which had various disadvantages such as it is slow, costly and is does not assure high quality. To overcome the disadvantages of existing system we used the automatic PCB defect detection technique using image processing.

This paper utilizes a non contact reference based image processing approach where a master image is loaded into computer and scanner scans the image of the PCB to be detected.PCB to be detected for defects is compared with master image using image subtraction method. The discrepancies between the images are considered defects.

II. EXISTING SYSTEM

As per the requirements, the PCB's (Printed Circuit Board) are manufactured in bulk. These boards will have to be compared with the master piece in order to ensure that the boards which are manufactured are in proper dimensions and measures. Since the boards are manufactured in huge amount the rate of testing the boards should be appropriate. The method used to test every board is manual inspection which takes more time since in every board the number of holes, the circuits and the width and length of the board needs to be tested with the master piece. The main idea behind the requirements is to have an image processing unit which does not have the major drawbacks. But the system involved in processing is by manual inspection which may lead to huge amount of errors.

The manual inspection which is adopted as a method for testing involves various disadvantages such as it takes more time to diagnose each and every unit of the board and also the rate at which the testing is done is very less when compared to the rate of manufacturing. This results in delayed delivery of the product. Also it is not just inspecting or testing a board but also it needs to be compared with the master piece for various factors which again would take more time. Hence the entire procedure takes more time and also since it is manual inspection there is a room for errors. Thus the existing system involves major disadvantages and a suitable method needs to be derived which overcomes the above mentioned drawbacks.

A. Manual Process

The method used to test every board is manual inspection which takes more time since in every board the number of holes, the circuits and the width and length of the board needs to be tested with the master piece. The manual inspection is slow, costly leads to excessive scrap rates and does not assure high quality. Multilayer boards are not suitable for human eyes to inspect. To overcome the problems of existing system, a new methodology is adopted. The master image of the PCB with proper resolution is stored in the computer. An image of the PCB to be tested is captured using camera. A template of a defect free PCB image and a defected test PCB image are segmented and compared with each other using image subtraction and other procedures. The dependencies between the images are considered defects and are classified based on similarities and area of occurrences. So the proposed system we are going to develop will reduce the time consumption and

ease the work. The disadvantages of manual inspections are slow, costly, leads to excessive scrap rates**.** It does not assure high quality**.** Defects cannot be detected in multilayer boards. Production rates are so high that the manual inspection is not feasible**.** It involves tedious jobs to human inspectors.

III.PROPOSED SYSTEM

As we noticed in the existing system, PCB defect detection is done manually. To overcome the problems of existing system, we are using computer and scanner to make the job automatic. The master image of the PCB with proper resolution is stored in the computer. We are using the scanner which is connected to the computer. Whenever PCB is kept on the scanner, scanner scans the image of the PCB. This system utilizes a non contact reference based, image processing approach for defect detection and classification and image processing algorithm for locating those defects on PCB board. A template of a defect free PCB image and a defected test PCB image are segmented and compared with each other using image subtraction and other procedures. The discrepancies between the images are considered defects and are classified based on similarities and area of occurrences.

To carry out the above mentioned process sensors are needed. Whenever computer accepts the PCB, the person who is responsible for doing this job has to take out the PCB and then he has to refresh the computer by some method using sensors, so that it will allow the next PCB to keep on the scanner, after keeping the PCB on the scanner, he has to inform the scanner to scan the PCB kept on the scanner by some method using the sensors. For the above two purposes of informing computer to scan and refresh, we are using two sensors. So whenever he keeps the PCB on the scanner, he can touch the place where the sensor is placed to allow the computer to scan the PCB. Then after checking for the PCB design, he can touch the place where another sensor is placed for the purpose of refreshing the computer to allow next PCB.

Another requirement is to provide a software installer for the above software. We need installers because with installers we can distribute and install applications to the PCs in tens or even hundreds times faster, than u can do it manually.

IV. DESIGN AND DEVELOPMENT DIAGRAM

The image of the Printed Circuit Board with no defects is loaded on to the computer. The Board which needs to be inspected is placed on the glass platform of suitable size. A 12megapixel camera is used in order to take the picture of the board. While capturing the image suitable light source is provided. The image captured is loaded on to the computer a web camera functionality can be given to the 12mp camera or a direct cable connection can be given to the camera to capture the image of the Board mounted on the glass platform. Glass platform is used in order to ensure transparency since the camera will be placed below the platform. The image captured will be considered for the further steps.

Instead of giving equal contributions to all the colors, in case of this context we have to decrease the contribution of red color, and increase the contribution of the green color and put blue color contribution in between these two below mentioned images. It is useful to be able to separate out the regions of the image corresponding to the objects in which we are interested, from the regions of the image that correspond to background.

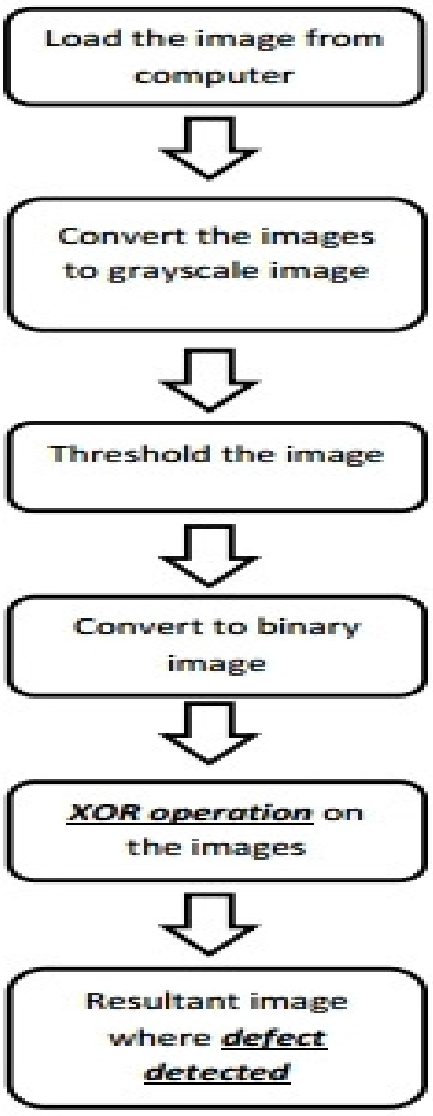

Fig 1: Architectural Design

Thresholding often provides an easy and convenient way to perform this segmentation on the basis of the different intensities or colors in the background or foreground regions of an image. In addition it is often useful to be able to see what areas of an image consists of pixels whose values lie within a specified range or band of intensity.

Input to a thresholding operation is typically a gray scale or color image. In the simplest implementation the output is a binary image representing the segmentation. Black pixels

correspond to background and white pixels correspond to foreground (or vice versa). In the simple implementations the segmentation is determined by a single parameter known as the intensity threshold. In a single pass, each pixel in the image is compared with this threshold.

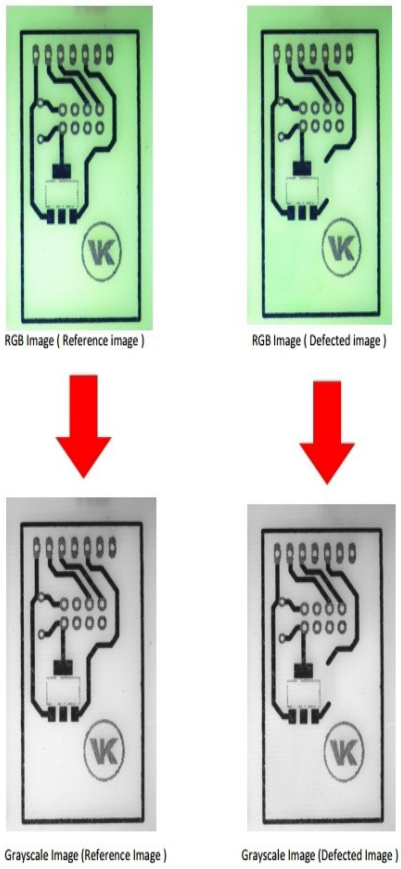

Fig 2: Image conversion to grayscale.

If the pixels intensity is higher than the threshold, the pixel is said to, say white in the output. If it is less than the threshold it is said to be black.

In more sophisticated implementation multiple thresholds can be specified, so that a band of intensity values can be set to white while everything else is set to black. For color or multi spectral images it may be possible to set different thresholds for each color channel, and so select just those pixels within a specified cuboid in RGB space. Another common variant is to set to black all these pixels corresponding to background but leave foreground pixels at their original color or intensity so that the information is not lost.

Each pixel in the image is compared with threshold. If the pixels intensity is higher than the threshold, the pixel is said to, say white (binary 1) in the output. If it is less than the threshold it is said to be black (binary 0).

V. XOR OPERATION ON THE IMAGES

The overview of the XOR/Subtraction operation process is shown in figure Fig 3.To perform the image subtraction operation, it is required that both images has same size in terms of pixels.

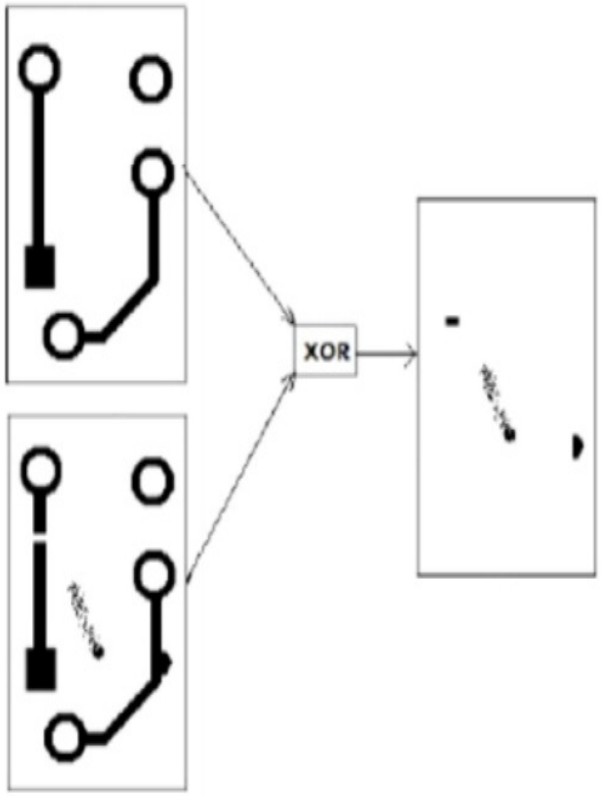

Fig 3: XOR operation.

The resultant image is obtained after comparing the image of the PCB with the master PCB image if defects are found, and if no defects are found it will result in blank screen else shows the missing tracks, lines, positions of improper track etc…

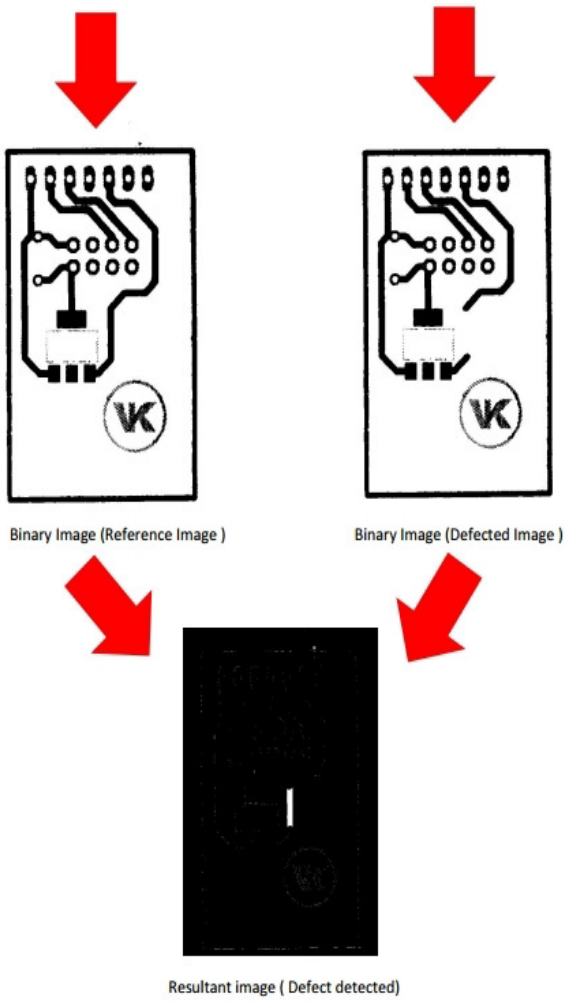

Fig 4: Resultant image showing defect

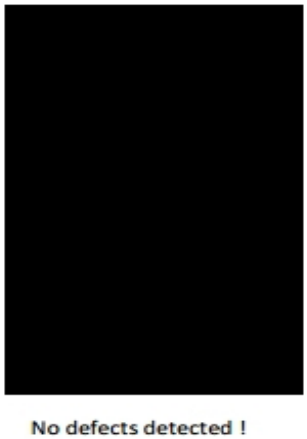

Fig 5:Resultant image without any defect

VI. CONCLUSION

It is very important and essential to examine Printed Circuit Boards for defects as they are importantly useful. Using Image processing techniques and algorithms, examination process has become fast, reliable and effective compared to manual process as it excludes labour intensive job.

Automated nature of the examination process makes it more advantageous than manual one.

REFERENCES

[1] Y. Hara, N. Akiyama, and K. Karasaki, "Automatic inspection system for printed circuit boards," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 5, no. 6, pp. 623– 630, 1983.

[2] Ajay pal singh chauhan, sharat Chandra bhardwaj for automatic inspection of printed circuit boards," detection of bare pcb defectsby image subtraction method using machine vision" proceedings of the WCE 2011vol 2