

# AUTOMATIC PCB DEFECT DETECTION USING IMAGE PROCESSING

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## ABSTRACT

A zero defect PCB ensures a high quality PCB which reflects to reliability and quality of final product. PCB manufacturing is very costly and time consuming process. So that it is necessary to avoid defects during manufacturing process. Especially for products with high level complexity. There may be improper printing of PCB film while printing film for bare PCB from photo which may be result in production of defected PCBs. In this paper, we are processing a technique in which a scanned image of bare PCB film which is printed by photo plotter compares with a image of PCB which is stored in a computer. From the results we can detect the possible defects like short circuit, track missing, open circuit, dry soldering etc. We apply the machine vision concept to inspect the bare PCB. We first compare a standard PCB image with a PCB image to be inspected using a simple difference algorithm that can detect the defected region. The purpose of this work is to detect defects in PCB film and finding out the defected area to avoid it before PCB fabrication.

**KEYWORDS:** Matlab, PIC microcontroller, Conveyer, PCB database and so on.

## INTRODUCTION

PCB (printed circuit board) is one of the most important key components in the automation and electronic industries. The bare PCB is used before the mounting or placement of components and soldering process. Along with other components, it is used to produce an electronic device or product. There are three steps involved in PCB manufacturing process, where the inspection is essential to detect defects. Printing film for bare PCB is the first step and mounting of components on the PCB surface is the second process.

And lastly the third process is the soldering of components. In this paper we apply the machine vision concept to inspect the bare PCB. To reduce the cost, the bare PCBs should be inspected before PCB manufacturing. In mass production of PCBs, the inspection of PCB is necessary, especially for high level complexity of boards. [1], [2].

Some major defects found on PCB :

NO.	Defect Name
1	Short Circuit
2	Breakout
3	Open Circuit
4	Track Missing

## LITERATURE SURVEY

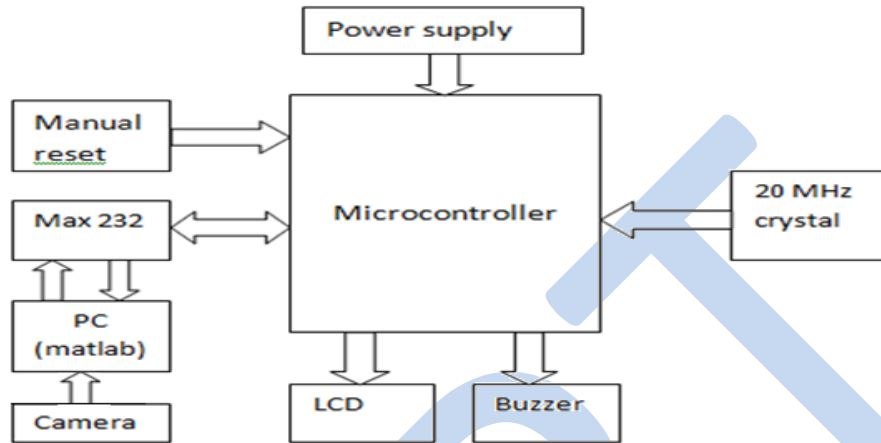
There are different methods for inspection of PCB. A individual operator inspect defect by looking at board in a manual inspection. But this method was yielding a poor results. Automatic optical inspection is preferred method for inspection of PCB. An automated visual printed circuit board (PCB) inspection is used to reduce problems occurred due to manual inspection. In research works mentioned in [1].

For instance, the work carried out by Wen-Yen, [4] did the direct subtraction of the reference to the test image to produce Positive (P), Negative (N) and Equal (E) pixels. Defects detected on P and N pixels. After that, defect classification is done based on P, N and E pixels. In current scenario PCB is inspected either for component inspection or for track inspection of fabricated PCB. Inspection system explained in [3] is for missing components or wrongly placed components in PCB. Defect detection and classification and localization method explained in [2] uses mathematical morphology and image processing tools. Besides the

need to detect the defects, it is also essential to classify and locate these defects so that the source and location of these defects can be identified.

If there is a fault in PCB then it results in a wastage of money of which is paid for manufacturing process of PCB. In this paper defect detection technique for PCB film is focused. The method explain in the paper can be applied for bare PCB images to detect faults due to etching, as PCB inspection after etching is also important.

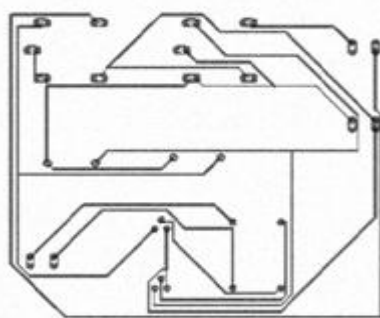
## METHODOLOGY



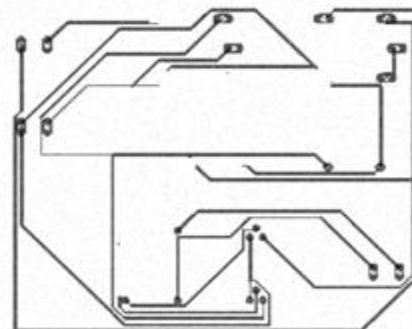
The PIC is used for controlling purpose. The camera is used to capture the image of PCB to compare with reference image of PCB (the PCB image which is stored in the computer) to identify the difference between two. MAX232 is used in RS232 communication with modern PC applications. It converts signal from an Rs232 serial port to signal suitable for use in TTL compatible digital logic circuit. These USB to serial converter cables makes easy to connect an RS232 serial device to our PC. The buzzer is used to indicate that the defect is detected in PCB. The type of fault and the number of faults detected are displayed on the LCD display.

## ALGORITHM USED

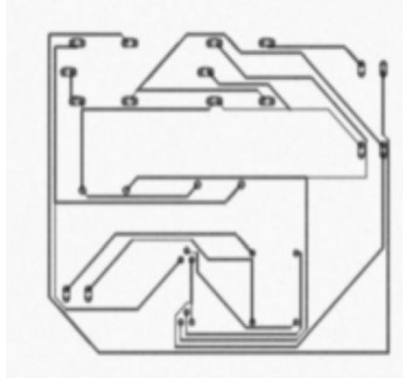
- Gaussian blur: The image stored in a computer is a binary image. The scanned image from PCB film has a gray scale pixel value. By comparing these two images we will get an undesired result. So before proceeding for operation on images, these two images should bring in to the same level of comparison. For this purpose, Gaussian blur algorithm is used.
- Affine Transformation: For proper alignment between scanned image of PCB film and the image stored in a computer affine transformation can be used. Affine transformation requires corresponding locations of three points from both images i.e. three points from scanned image and location of same points in rendered image. For this three fiducials are marked on PCB layout which will appear on both images. These three fiducials locations from both images are used for affine transformation.
- Template Matching : For finding out fiducials locations from both images ,template matching algorithm is applied on both images with fiducial image as template.
- Image Difference : It is used to get the difference between the scanned image of PCB film and the reference image (image which is stored in a computer). This method compares both images pixel-by-pixel and gives the difference between two.



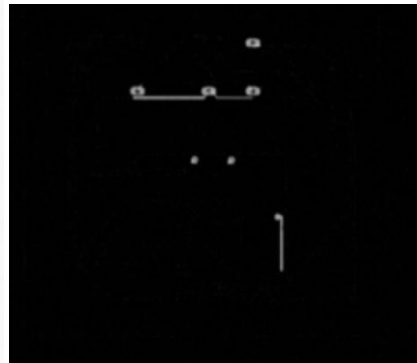
**Fig 1**  
Stored PCB image



**Fig 2**  
Captured image

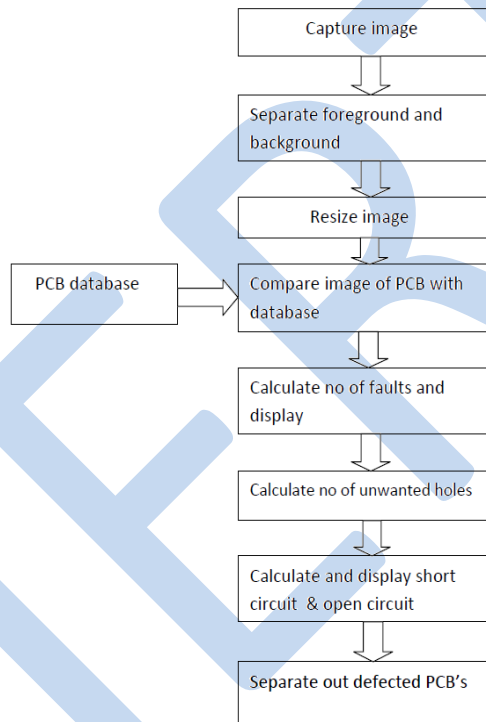


**Fig 3**  
Gaussian Blur image



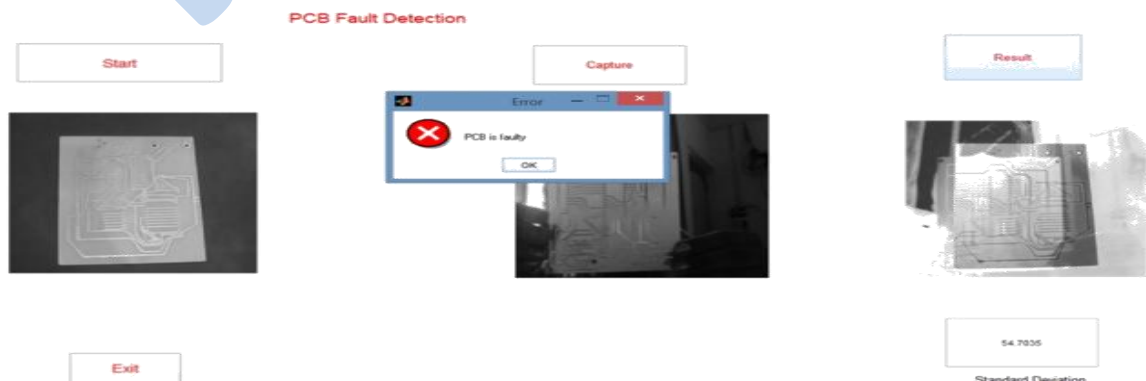
**Fig 4**  
Defected image

**FLOWCHART**



**RESULT**

In this framework, we are showing results on GUI because in this user can load the image, begins the preparing on it by choosing given graphical components for it. We have built up our model on a real time framework and its outcome is getting shown on GUI. When start button on GUI is get pressed then DC motors begins running so that PCB likewise moves towards the camera. In the first box we can see PCB image which is already stored in PC, though second box indicates real time PCB image. We can see handling time on the screen. The third box indicates defects which are obtained after performing difference operation. After few moments it shows number of defects such as line defects and hole defects.



## CONCLUSION

The framework was turned out to be an option approach to productively recognize the imperfections. Besides, the framework is shabby as mechanical arrangement office is not all that costly. A few examinations were performed to approve the execution of the PCB assessment framework. The computational time for this framework is around 17.95 seconds. Computational time could be enhanced further by actualizing the examination on superior figuring stage or utilizing little measurement of PCB tests

## REFERENCES

- 1) Ismail Ibrahim, Syed Abdul Rahman Syed Abu Bakar, Musa Mohd Mokaji, Jameel Abdulla Ahmed Mukred, Zulkifly Md Yusof, Zuwairie Ibrahim, Kamal Khalil, Mohd Saberi Mohamad, "A Printed Circuit Board Inspection System with Defect Classification Capability," International Journal of Innovative Management, Information & Production, Volume 3, Number 1, pp. 82-87, March 2012
- 2) Malge P.S., Nadaf R.S., "PCB Defect Detection, Classification and Localization using Mathematical Morphology and Image Processing Tools," International Journal of Computer Applications (0975 – 8887), Volume 87, Number 9, February 2014
- 3) Sanveer Singh, Manu Bharti, "Image Processing Based Automatic Visual Inspection System for PCBs," IOSR Journal of Engineering (IOSRJEN) ISSN: 2250-3021 Volume 2, pp. 1451-1455, June 2012
- 4) Wu, Wen-Yen, Mao-Jiun, J. Wang and Chih-Ming, Liu. "Automated Inspection of Printed Circuit Boards Through Machine Vision." 1996 Computers in Industry. Vol. 28. Issue 2. 103 – 111.

UNREFERENCED