# PCB Fault Detection using image processing in Matlab

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***Abstract:*** *Now a days ,we see in manufacturing companies the requirement of zero defect PCB are increasing in the market. So that to meet such finished goods, industry has required adopting the automation because decision made by human manual inspection often involves subjective judgement. In this project we are using image processing in MATLAB to detect fault on bare PCB in real time and results are shown on a GUI using MATLAB program.*
***Keywords:*** *Image processing, PCB, MATLAB, Defect Detection.*

## I.    Introduction

Bare printed circuit board is a PCB without any placement of electronic components . In order to reduce cost spent on manufacturing caused by defected bare PCB, the bare PCB must be check firstly.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 final etching inspection process ,PCBs are considered as the scrap and can be thrown out from process .The 70% of the PCB fabrication cost is utilized for etching process ,so we mainly focus on ethching process. We detect fault and classify them based on overetch ,underetch or both. We using subtraction method to detect fault by comparing template PCB and real time PCB .
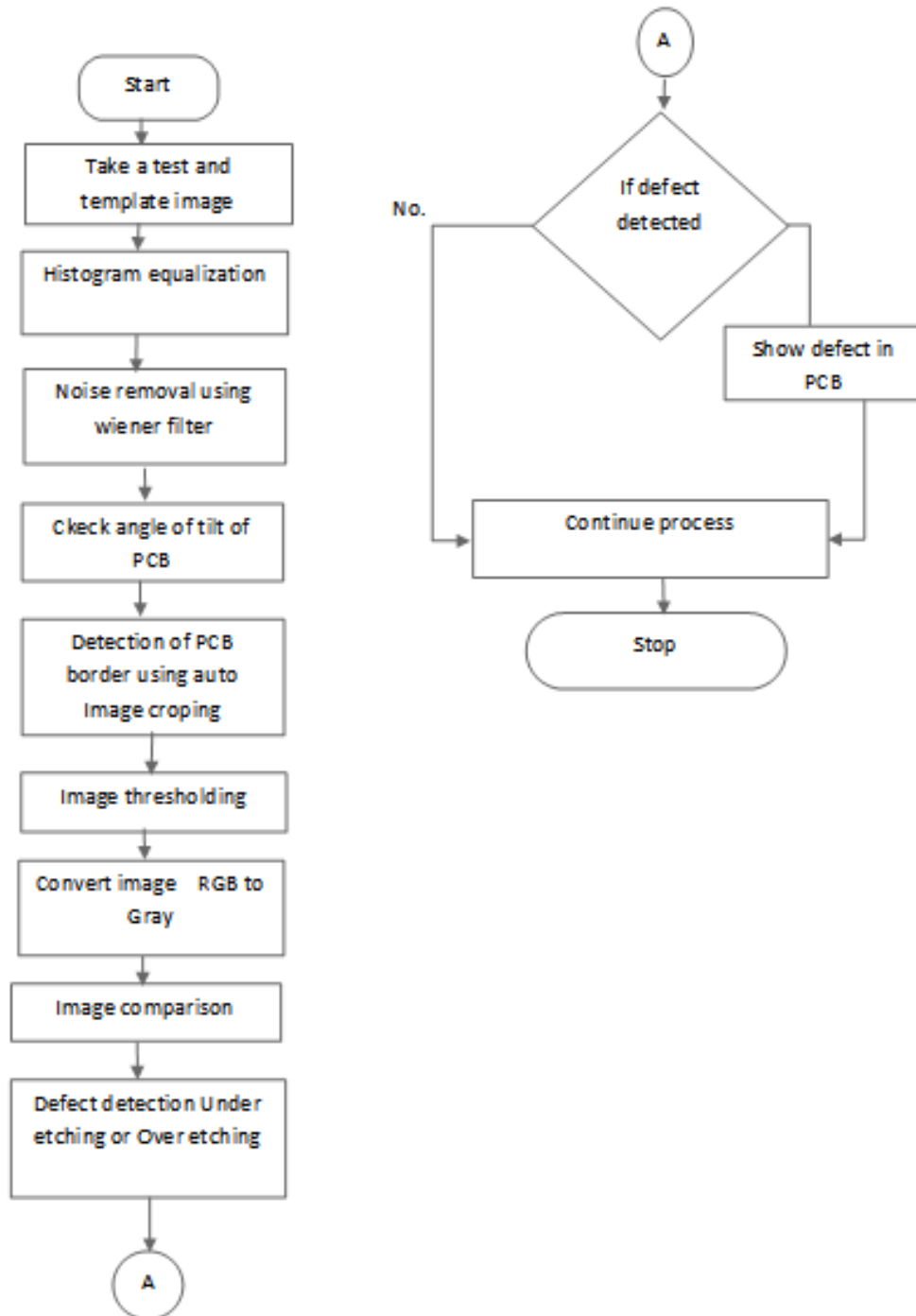
## II.    Existing Methods

In literature, Wu et al. (1996), Rudi Heriansyah and Abu-Bakar (2004), Rau and Wu (2005), and Ibrahim et al. (2011) have proposed PCB inspection systems in classifying defects. in this project, a new PCB inspection system on PCB pix has been proposed by means of adapting comparable algorithm that comes from Ibrahim et al., (2011). photograph subtraction must be used to locate defects at the PCBs. but, image subtraction operation that has been applied to come across defects among defective and template pictures cannot be used without delay as it contributes unwanted noise because of misalignment and uneven binarization and hence, the accuracy of the disorder detection can be reduced. since the nature of real PCB snap shots is extraordinary compared to pc generated PCB images, an picture registration should be hired in the beginning so one can get nicely-aligned faulty photo towards template picture. Then, all pixels within the template image are subtracted in opposition to the registered faulty picture to get two output pics referred to as high-quality and poor photographs. subsequent, with the aid of applying photograph thresholding and filtering strategies, noise unfastened high quality and terrible pix are produced. beginning from here, the two photographs may be used as inputs for illness class.

## III.    Proposed System

Quality is a degree of achievement in manufacturing of manufacturing centers, subsequently an attempt is often made to achieve one hundred% exceptional warranty, so the great and simple manner to gain product first-rate is with the aid of making sure defect free product from each method. therefore on this machine a PCB inspection is proposed and the algorithm especially makes a speciality of the defect detection. consistent with Khalid the techniques of PCB defect detection is usually categorised into  companies, which is photo subtraction and characteristic extraction. We use MATLAB as a tool to perform various tasks of illness detection in PCB. MATLAB is a name that stands for matrix laboratory which is a high-performance language for technical computing. It

integrates computation, visualization, and programming in an surroundings wherein troubles and answers are expressed in familiar mathematical notation.

Right here we using algorithm as follows:

```
          ┌─────────────┐                                    ( A )
          │    Start    │                                      │
          └─────────────┘                                      ▼
                 │                                       ┌───────────┐
          ┌─────────────┐                     No.        │ If defect │
          │ Take a test │         ◄───────────────────── │ detected  │
          │ and template│                                └───────────┘
          │    image    │                                      │
          └─────────────┘                                      ▼
                 │                                       ┌──────────────┐
          ┌─────────────┐                                │ Show defect  │
          │  Histogram  │                                │   in PCB     │
          │equalization │                                └──────────────┘
          └─────────────┘                                      │
                 │                                       ┌──────────────┐
          ┌─────────────┐                                │   Continue   │
          │Noise removal│                                │   process    │
          │ using wiener│                                └──────────────┘
          │    filter   │                                      │
          └─────────────┘                                ┌──────────────┐
                 │                                        │     Stop     │
          ┌─────────────┐                                └──────────────┘
          │ Ckeck angle │
          │ of tilt of  │
          │     PCB     │
          └─────────────┘
                 │
          ┌─────────────┐
          │Detection of │
          │ PCB border  │
          │  using auto │
          │Image croping│
          └─────────────┘
                 │
          ┌─────────────┐
          │    Image    │
          │ thresholding│
          └─────────────┘
                 │
          ┌─────────────┐
          │Convert image│
          │  RGB to Gray│
          └─────────────┘
                 │
          ┌─────────────┐
          │    Image    │
          │ comparison  │
          └─────────────┘
                 │
          ┌─────────────┐
          │   Defect    │
          │ detection   │
          │Under etching│
          │or Over etch │
          └─────────────┘
                 │
               ( A )
```
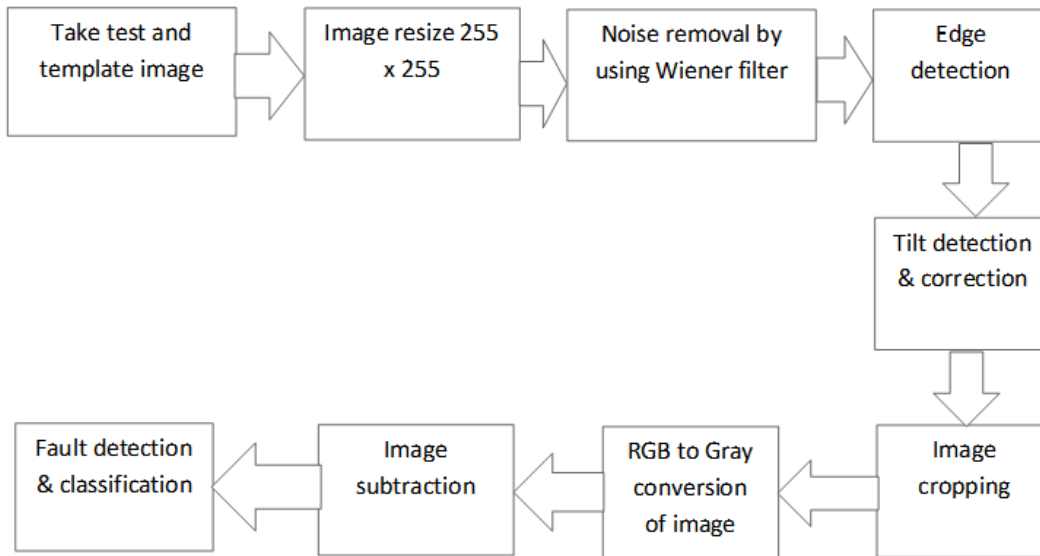
## IV. Block Diagram



**Fig 1: Block Diagram**

## V. Block diagram description

First take check and template snap shots. Then image resize into 255*255. After that noise might be put off by using the use of wiener filter then we use canny detection method for edged detection.While capturing image from web camera it may be tilted image so after edged detection we use tilt detection and correction then image cropping will be done .For comparision we convert RGB image into gray image ,image will get subtract from template image and results shown on GUI in MATLAB.

**GUI :**

The GUI provides easy access to all the features of PCB defect detection system. The following Images displayed describe the GUI in detail.
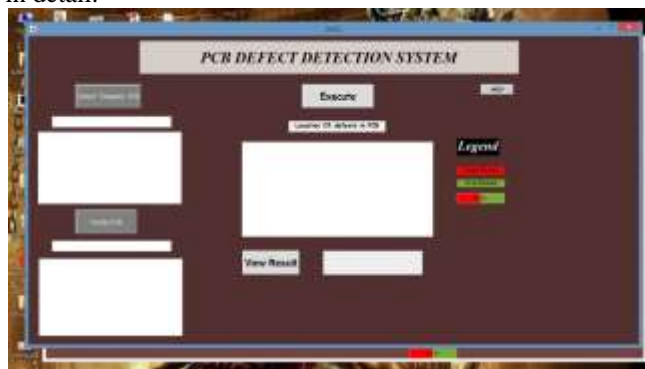


## VI. Applications

In PCB manufacturing companies and also this technique is useful for small scale industries.This system can be used for detecting and classify the defects as below :
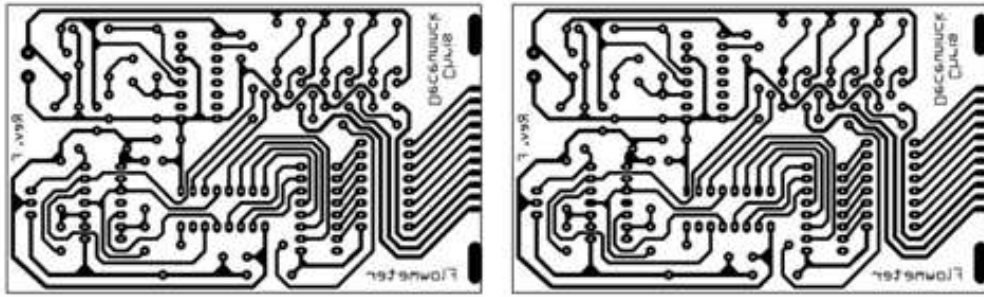1) Under Etching,
2) Over Etching.

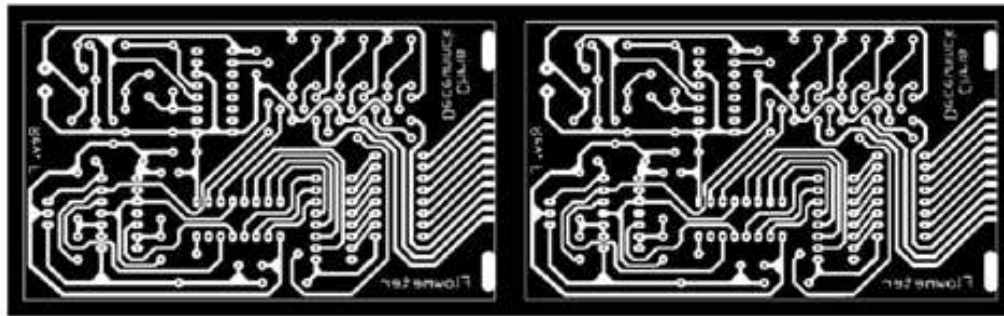## VII.   Result



**Fig.Registered output Image**



**Fig. Complimented and Thresholded output**



**Fig. Image Subtraction Output**

## VIII.   Conclusion

We have provided the implementation of a way to come across PCB errors and classify them through MATLAB. Our technique suggests that it's miles feasible to apply the software and hit upon the errors present in PCB in order that further malfunction may be avoided. Its objective is to hit upon the mistakes that are present in PCB throughout Mass manufacturing. it could additionally be utilized in small scale like using it in university labs to stumble on the errors in PCB which engineering students have to make for their publications. We agree with that PCB making or production can be increased correctly and errors quotes can be decreased appreciably through the usage of this software program.

## IX.   Future scope

Future works consists in revising the methods used to analyze PCB with components. In this case it should be detected components absence and replacement, misaligned components, etc.
Now we work on gray scale image in future we will work on RGB images.

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