DEFECT DETECTION IN PCB USING K-MEAN CLUSTERING AND NEUTROSCOPY

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Abstract- *Printed circuit board (PCB) mechanically supports various components and electrically connects these components using tracks. The main goal of our work is to Detect the no. of defects in the PCB image and area of defects .The location of electronic parts is fixed and inspection time reduced. These defects are divided into two categories potential and fatal defects.Defects in PCB are in the form like missing hole, breaking lines, wrong hole size etc. During manufacturing Some defects occur in the PCB tio find these defect ,we use two techniques.These techniques are:- 1.Neutroscopy 2.K-mean Clustering. This paper proposes a PCB defect detection and classification system.*

Key words— PCB; Defect detection; Subtraction Operation; Neutroscopy; K-mean Clustering.

1. INTRODUCTION

Printed circuit board connects electronic components together with the help of tracks [1]. During the manufacturing process of PCB various defect are caused which make our PCB unsuitable for use [5][6] . To make them usable first we have to find these detects [1]. These detect are in the form of like missing hole, breaking lines, wrong hole size etc. are PCB defect detection has great impact on the PCB manufacturing caused by the defected PCB [7]. In order to minimize these defect caused by the wrongly etched PCB panel various techniques are used [3]. The techniques used for detection are as:

1. Neutroscopy

2.K-mean clustering

1. **Neutroscopy:**

In Neutroscopy theory, every event has not only a certain degree of the truth, but also a false degree and an indeterminacy degree and work independently from each other. With the help of Neutroscopy the defects are found with accuracy. In this we use image subtraction operation .Image subtraction operation two images are subtracted to find difference between these two by pixel [10].

2. K-mean Clustering:-K-mean clustering generates a specific no. of disjoint, flat clusters. It is well suited to generating globular clusters. The k means method numerical unsupervised and non deterministic and iterative [14]. K-mean clustering is using the image subtraction operation to find the difference between the reference and test image.

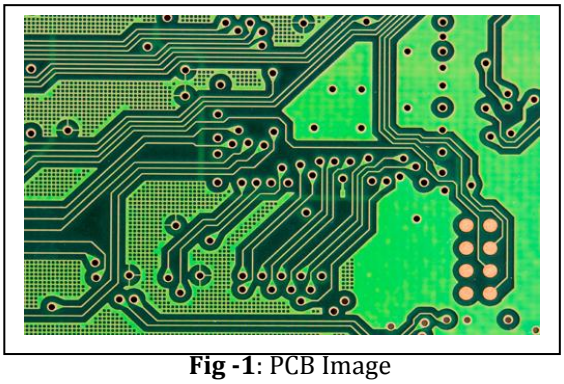

Fig -1: PCB Image

2. LITERATURE SURVEY

In 2011 Ajay Pal Singh Chauhan- The bare PCB is analyzed and the defects of PCB are extracted in terms of various parameters. These parameters can be taken as referential data base for further analysis to fabricate defect free PCB and can assist in making an automated system for inspection. In order to use this method in an industrial application some improvements need to be done. Future work consists of inspecting and analyzing a PCB with Surface Mounted Devices.

In 2013 Yang Halin- This used linear transformation method in enhancement of image characteristic then gray scale statistical matching method is used to detect the defects.

Zuwairie Lbrahim-An automated visual printed circuit board (PCB) inspection system proposed in this paper is designed specifically to detect various types of defects occurred during circuit printing process in manufactory. Two-dimensional HAAR wavelet transform is incorporated in the PCB inspection algorithm of the inspection system. During the inspection, two type of images are required; reference and tested PCB images. The wavelet transform is applied to the reference and tested PCB images. According to previously proposed wavelet-based PCB inspection algorithm, a reference comparison between the reference and tested PCB images has been done in wavelet domain by employing image difference operation. However, in practice, this operation also bring along the unwanted noise due to misalignment and uneven binarization. Thus, in this paper, for the real-time implementation, the image difference operation between the reference and tested PCB images is replaced with image subtraction. The output of the image subtraction operation can be differentiated as positive, negative, and zero images.

In 2014 Kaur Kamalpreet-The detection and classification results of proposed method are promising. Most of the defects like wrong size hole, missing hole, missing conductor, pin hole are successfully detected without any misclassification. The proposed method has some drawbacks like it require the same size of template and defective images. And it requires orientation of test image and base image. Also during computation of defect detection and implementation this operation bring along the unwanted noise due to misalignment PCB have been proposed in the literature to Moganti divided the PCB inspection algorithms into three main categories:
1. Reference comparison (reference-based) approach
2. Design-rule checking (non-referential) approach
3. Hybrid approach which involved a combination of reference comparison and design-rule approach.
Beant Kaur-The method for detection and classification of defects in Printed circuit boards using image subtraction has been presented in this paper. Image subtraction method is one of the simplest methods for the inspection of the PCB defects. The defects like missing hole, over and under etching, wrong whole size defects and missing conductor and break lines have been detected and classified in this paper. It is concluded from the results that defects can be detected and classified easily with the help of image subtraction method. But image subtraction has some drawbacks like it require the same size of base and test images. And it requires orientation of test image and base image.

In 2015 Namita Kalyan Shinde -This provides a design of PCB automatic defect detection system based on image processing technology. This design is a non-contact, fast, accurate and highly effective detection. This PCB defects detection technology which can not only detect open circuit and short circuit, but also can detect wire gaps, voids, scratches defects etc. For further improvement extracting the structural features based on these regional properties gives the detailed information about the defects.

Mukesh Kumar1-An Algorithm for PCB image enhancement as well as standard data generation for defect detection in bare PCB is proposed in this paper. The quality of PCB image is enhanced using color plane extraction, LUT transformation thresholding, filtering and advance morphology after that standard data is generated by Particle analysis. In future, this standard database will be used in referential approach of PCB defect detection. Time taken to execute the proposed algorithms 14 ms means 71 PCB can be inspected per second.

Surendra Khushwaha- A Computer Vision system for printed circuit board (PCB) automated inspection was developed to detect bare-board manufacturing errors, like missing tracks, circuit shorts, missing holes, opens, breaks, etc. The system uses standard PCB images; their characteristics are saved in a database. The adopted referential approach compares PCB images to the standard images. Some difficulties were observed. One of them consists in the pre-processing technique. It is important that the environment lighting should be uniform and that all inspected PCB belong to the same category. It permits to choose a satisfactory segmentation technique, which can be applied to all PCB images. In the other hand, if it doesn't happen, it will be necessary to calibrate the system every time we change the reference PCB or environment illumination attempting to detect PCB fails, we propose a new methodology that reduces the computer complexity of scanning the whole board. We considered the PCB separated in small images. It is possible after the system identified the regions that contain fatal errors. A connection analysis method is applied to each small image.
Mohit Borthakur-Automatic PCB inspection is needed to inspect the PCB for defect, anomalies and fault. Among the variety of algorithms, the image difference operation has been emphasized more in order to get better results. The system proposed is not a generalized system but a dedicated system for a particular PCB and can be optimized to a level. This has also been noted that the system cannot be generalized as each PCB inspection is different from its assembly point of view. Hence it is noted that different operations are found suitable for different PCBs according to its features. The drawbacks of different proposed algorithms have been studied and accordingly an optimal approach is used to minimise the shortcomings and increase the operation speed. The major limitation of existing inspection systems is that all the algorithms need a special hardware platform to achieve the desired real-time speeds. This makes the systems extremely expensive. Any improvements in speeding up the computation process algorithmically could reduce the cost of these systems drastically.

3. RESULT AND DISCUSSION

For Proposed work we capture the PCB images. Input can be any camera grabbed images after collecting database we applied the neutroscopic an d k-mean clustering to find the defects Following are the screenshots related to work:-

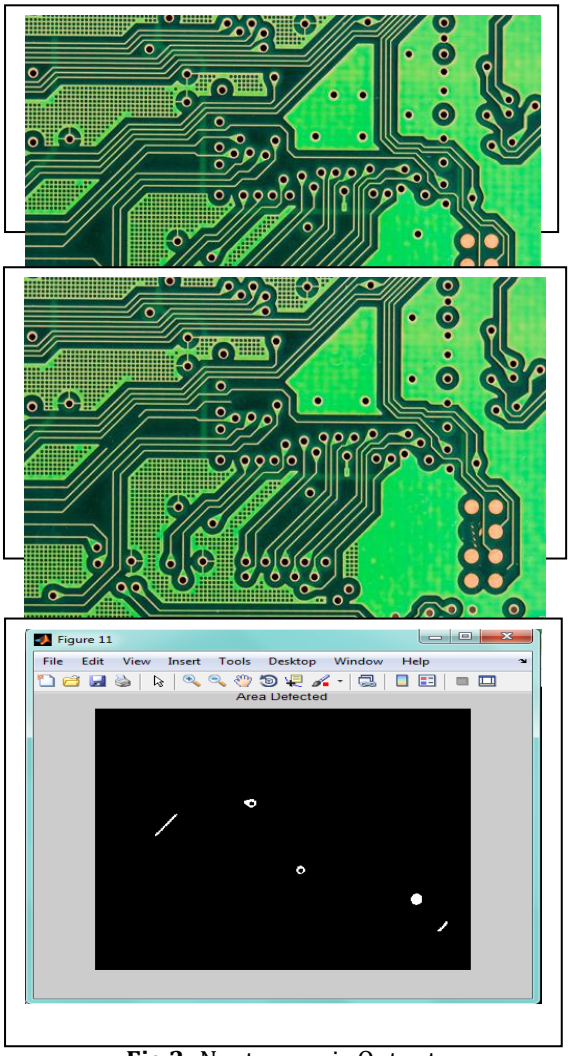

Fig.3- Neutroscopic Output

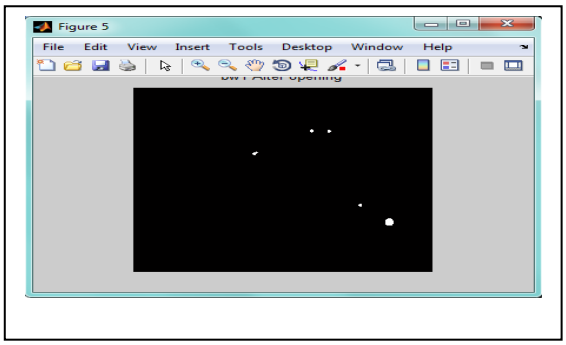

Fig.4- Clustering Output

Neutroscopy and Clustering applied on reference image and test image. The result found when we apply image subtracting on the both images. Defects are shown in Fig.3 and Fig.4 .

4. CONCLUSION

Our aim is to find defect present in PCB during manufacturing. Defects in PCB are in the form like missing hole, breaking lines, wrong whole size etc are detected. To detect these defects we used two techniques k-mean clustering and neutroscopy. Neutroscopy provides better results in comparison to k-mean clustering. Neutroscopy gives more accurate results than k-mean clustering. Common operation used in both techniques is image subtraction operation. It finds differences between reference and test image by pixel.

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