A Review on Study of Fault Detection System for Assembled PCB

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Abstract -*In this review paper discusses test strategies for fault finding for the assembled Printed Circuit Boards (PCB). Presently there are many test strategy are available for fault diagnosis in assembled PCB. In that most of the test techniques to inspect the PCB based on manual visual inspection as well as image processing techniques.*

Keywords—*Printed circuit board (PCB), Image Processing, Surface Mount Technology (SMT), Manual Visual Inspection(MVI), Visual inspection(VI), Functional Test(FT)*

I.   INTRODUCTION

Printed circuit boards (PCBs) are at the heart of modern electronic equipment. Without them it is impossible to build modern electronics products i.e. computers, cell phones, TVs, Blu-ray players and many other electronic products. Printed circuit boards difficulty can be depend on film of the PCBs it is one film or many films. Single-sided circuit boards use through-hole components whereas multi-layered boards are likely to use surface mounted components. The design of the printed circuit board can be as important as the circuit design to the overall performance of the final system. The design of PCB and testing was divided into three main fields: process forming, board design, and PCB analysis.

In manufactured PCBs, there are various types of faults occurred. We must test these PCBs to detect faults and it is essential to establish an efficient testing method. Based on testing method strategy general literature review present for fault diagnosis for assembled PCB.

II .*Review on General /Common test techniques for defect detection in PCBS.*

Most common test/inspection strategy in production line its gives three steps In first step performed Manual Visual Inspection (MVI) in this step find defect in PCB by Manually such as absent components, misplacement, wrong location of I.C. chips, wrong parts, poor solder joints and open track etc. In second step performed In-Circuit Test (ICT), and in last step performed Functional Test (FT), as seen in Fig. 1 Common test techniques for defect

detection in PCBS. In this the grid patterns indicates fault coverage in each test 'A' grid indicate Fault Cover in MVI Test, 'B' grid indicate Fault Cover in ICT Test, 'C' grid indicate Fault Cover in FT Test and finally 'D' grid indicate Overlapping Fault. In this system engineers have spent little time analysing missed fault coverage as well as overlapping fault coverage, resulting in both overlapping fault coverage and for some fault types, missed coverage. Overlapping fault coverage as well as missed fault coverage gives lower quality of final products and more field failures may lead to severe performance degradation.
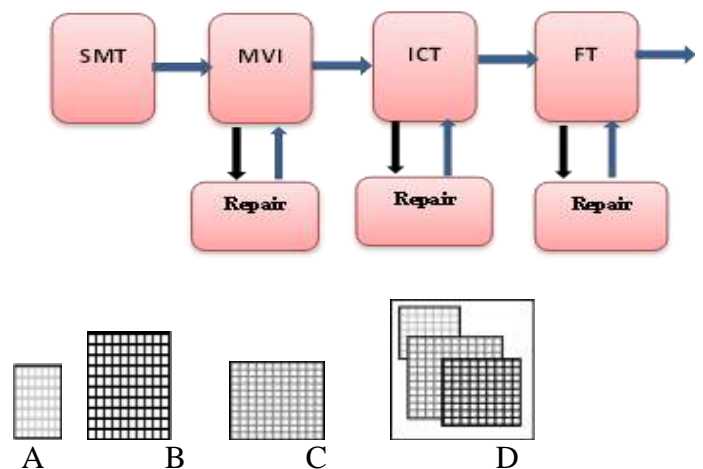

Fig. 1 Common Test techniques for defect detection in PCB.

III. *Review on VI Mark investigation techniques for defect detection in PCBS.*

Ambreen Insaf, Mirza Salman Baig, Zeeshan Alam Nayyar and Mirza Aman Baig describe in their research on Techniques to Identify and Test PCB Faults with Projected Result. In a PCB components mounted are different combinations such as series, parallel or mix parallel or series combinations. It is difficult to identify the marks of these combinations. Therefore, in such cases the best solution is to equate the mark of defective PCB with known good PCB. If the marks of the same pins are identical then there is no fault at that point. However, if the marks of the same pins are different then consider it as an

indication of fault .In figure 2 displays the VI checking instrument which denotes the relationship of defective PCB with Known good PCB.In these techniques used following steps.

- Take good PCB and Faulty PCB
- Used three testing probes probe A (red) used for check different test points in good PCB , probe B (green) used for check different test points in faulty PCB and probe (grey) used for common grounds for both PCBs
- Touch the two testing probes (A and B) at same pin of both PCB of the similar ICs (point) and other components on the both PCBs and observe the reading. If the reading of the different pins are identical like then there is no fault at that point. However, if the reading of the same pins is different then consider it as an indication of fault.
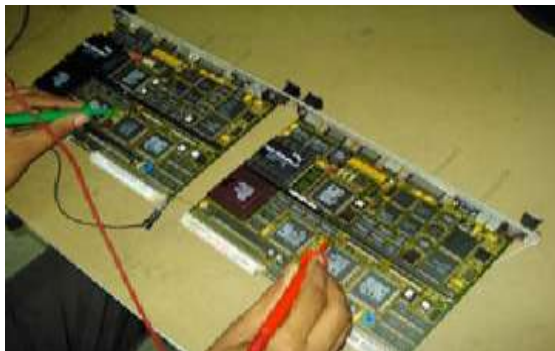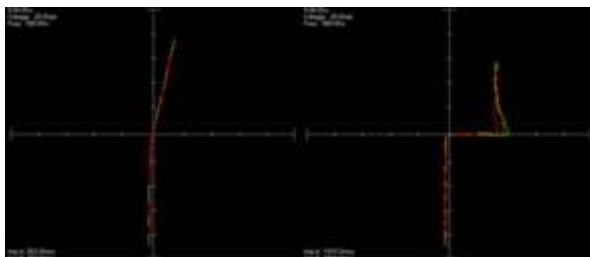

Fig. 2 VI Checking instrument

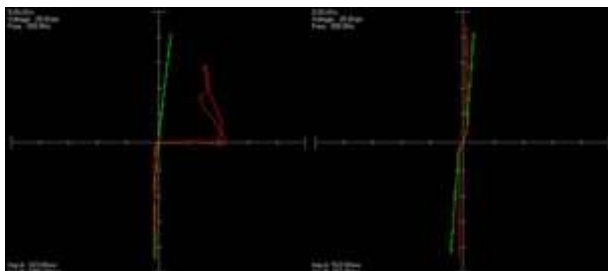Fig. 3 Equal reading at same pins of two similar PCBs.

Fig. 4 Dissimilar reading at same pins of two similar PCBs.

So in Fig. 3 presented no fault at that same point and Fig. 4 presented fault at that same point. But, these techniques PCB fault examination and troubleshooting needs decent speculative information and logical thinking of person who execute the VI (Visual inspection) reading. Because many times readings are slightly different, so it is up to persons decision either consider it as component tolerance or indication of actual fault.so we need some experienced based techniques and measures point the fault

IV. Review on Image Processing techniques for defect detection in PCBS.

E.K.Teoh, D.P.Mita, B.W.Lee and L.K.Wee describeed in their research on techniques used to inspect for defects on Surface Mount PCBs. In this they mentioned different five types of defects. These defects given as absent components, misplacement, wrong positioning of I.C. chips, wrong parts and poor solder joints. For defect analysis use image processing technique. For detection of absent components, misplacement and wrong positioning of I.C. chips use common techniques. First image is captured, filtered, windows defined and then histogram distribution graph obtained for every window defined. During image acquisition, lighting plays a major role in obtaining the various features for the classification purposes.

Ziyin LI and Qi Yang described in their research on PCB automatic defects detection system based on Automatic optical inspection (AOI) technology. In automatic optical inspection is uses image processing, computer and automatic mechanism technology to detect PCB defects. This method can detect PCB defects given as open-circuits, short circuit defects, gaps, marks and holes.
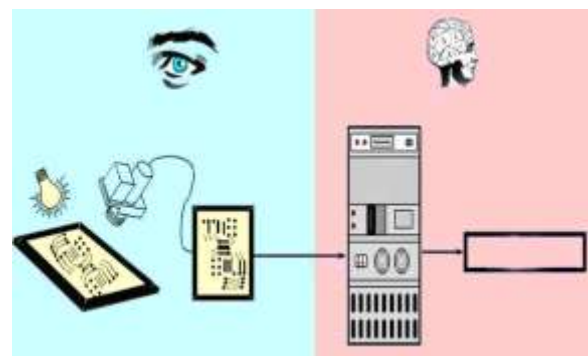

Fig. 5 AOI Defects detection system for PCBS

As shown in Fig 5 the handling technique of the AOI system includes three steps.

- Firstly, using Charge Coupled Device (CCD) array or linear CCD PCBs' images are caught under unchanging brightness.
- Secondly, the processed PCB image and valuable features are taken out.
- Finally, combined with the image features of good products, the types, levels and coordinate positions of PCBs are found by pattern recognition algorithms.

Major problems in automating surface mount PCB inspection method or AOI inspection method is that the images used are either gray level or binary and it is very sensitive to change of lighting conditions with very small amount. So it increases cost of the system because in various lighting conditions it is necessary to have different sets of lighting equipment's like, cameras and X-Y table and for attain good results, the different lighting way can be selected according to the characters of the objects' surfaces. So it will increase the cost of system. Fig 6 shows the flow chart for fault detection using image processing.
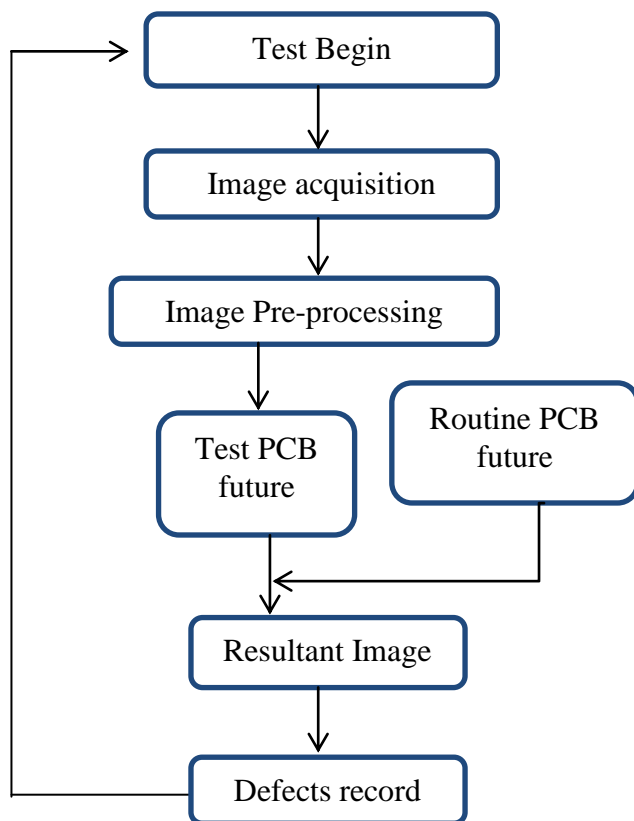

Fig. 6 Flow chart for fault detection using image processing

V. CONCLUSIONS

In short, with the quick improvement of PCB industry and the progress of manufacture skill, the traditional general /common test techniques method meet current requirements but Overlapping fault as well as missed fault coverage means lower quality of dispatched products and more field failures .In VI Mark investigation techniques method meet current requirements but it required more time to analysis fault in PCB. AOI technology for defects detection method can provide very significant and valuable information. Which tests are used in which production step, however depends on many factors. It makes sense because of the high level of complexity of modern assemblies to combine different tests with each other to get an error free product after production.

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