A Review On Methods For Missing Components Detection on PCB

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Abstract:- To cope up with the obstacles in the method of survey of absent component detection for Printed Circuit Board (PCB), the computer vision application plays an important role. A Printed Circuit Board is used to automatic help and electrically ties the electronic components using conductive route, track or signal traces etched from copper sheets laminated on to soon conductive substrate. The automatic checking of PCBs performs a aim which is traditional in computer technology. The motive is to relieve human checker of the difficult and inefficient task of examine for those defects in PCBs which could lead to electric failure. This paper is a bird's eye view on various existing approaches which performs automatic testing on PCB.

Keywords—defect recognition, image subtraction, image enhancement, image processing, computer vision

I. INTRODUCTION

Computer visions are often used to check the functionality of a PCB assembly. Today, PCBs have made developed to become more interconnected in design, single, multi layered and are connected with increasingly compressed components. It has made quality control of PCBs more exacting and difficult. Currently, computer vision combined with in-circuit-testers (ICT) are the most prominent systems that are used to check the functionality of a PCB assembly. This is because computer vision method provides better quality control in less cost. Inspection systems placed at correct sections along an assembly line will help to reduce the rework cost which would eventually give better results during the electrical testing time. Components on an assembled PCB come in a large range of sizes, colours, shapes and incomparable. These variations seem to be the major restriction in most of the existing defect detection techniques. Variations in the type of defects present on a PCB designing and innumerable fabrication technologies of electronic components have made development of computer vision systems a challenging difficulties in the last few decades. In the development of these systems, number of studies has outlined missing components as one of the top five common defects and the need for computer vision systems to have suits algorithms to subsist these defects. This paper conducts a survey on various approaches already existing and the limitations still in automatic PCB testing are discussed in the following section.

1.1 SURVEY ON AUTOMATIC PCB TESTING

Here, the various methods suggested by authors are as follows in survey.

[1] The hardware consists of IR sensor and webcam, DC motor and motor driver IC, 89s52 microcontroller board, conveyor assembly and MATLAB software is used. An IR sensor detects the PCB and stops the PCB exactly in front of the webcam. On pc MATLAB software is present which automatically takes the picture of PCB. The MATLAB software will then analyze and compare the PCB with OK PCB based on the color algorithm. If any component is missing from PCB our software will result the missing component in PCB and separator will separate that PCB as faulty PCB PC will send the information to controller about whether it is faulty or not and PCB will get sorted out in particular bucket with help of our project automatically.

[2]This method works on while mounting the components on the surface of PCB there are five problems(poor solder, acceptable poor, good, acceptable excess, an excess) these problems solved by using Automatic Optical Inspection (AOI) system for the identification of solder joint defects on PCBs assembled in Surface Mounting Technology (SMT). This diagnosis is solved by neural network approach as a pattern recognition problem. The images are captured from the board and the region of interest for the diagnosis is extracted using the horizontal energy and the vertical energy and the correlation coefficients. Three types of feature vectors are evaluated from each region of interest, including geometric features (Gfeature), wavelet feature (W-feature), and the two features together (GW-feature). The performances of three classifiers which are the Multi-Layer Perceptron (MLP), the Linear Vector Quantization (LVQ), and the K-nearest neighbor classifier are compared. The MLP network with the GW-features has achieved to the best recognition rate (98.8%) as a result.

[3] Machine Vision PCB Inspection System is applied at the first step of manufacturing, i.e., the making of bare PCB.Comparison of a PCB standard image with a PCB image, using a simple subtraction algorithm that can highlight the main problem-regions & seen the effect of noise in a PCB image that at what level this method is suitable to detect the faulty image. Focus of in this method is to detect defects on printed circuit boards & to see the effect of noise. Typical defects that can be detected are over etchings (opens), under-etchings (shorts), holes etc

[4]This method presents a novel integrated system in which a number of image processing algorithm are embedded within a Genetic Algorithm (GA) based framework in order to provide an adaptation and better quality analysis with less computational complexity. Noise elimination technique using window-filtering has been used in this procedure. The window-filtering technique is also capable of highlighting identification information of component (eg:IC identification number).

In this method [5] the author proposed a PCB defect detection and classification system using a morphological image segmentation algorithm and simple the image processing theories. However, 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. Based on initial studies, some PCB defects can

only exist in certain groups. Thus, it is obvious that the image processing algorithm could be improved by applying a segmentation exercise. This proposal uses template and test images of single layer, bare, grayscale computer generated PCBs.

The authors Malge and Nadaf [6] Proposed Bwlabel algorithm, used to deal with the PCB images under the condition of backlighting. According to the feature of Bwlabel algorithm extract and match the jack center indexes for every component, calculate the jack center connection angle, and generate jack center positioning data, figuring out the jack center coordinates. Combining with camera parameters, both the radial and tangential lens distortion are corrected.

The system experiment results show that the requirement of production has been met with accuracy of positioning that minimum jack diameter of 2.32mm and average time of 0.21s, which provides coordinates information for automatic assembly operation by manipulator.

1.2. LIMITATIONS OF EXISTING APPROACHES

In existing system misplace of component is detected and different types of soldered defects (cracked joint, lifted component, flux residues, incomplete joint, poor penetration).

Also by using existing system we can find the missing component but which component is absent we cannot find out easily.

II. PROPOSED WORK

The suggested work considers the disadvantages of the present methods and planned to solve the problems in image processing based automatic PCB testing by planning to propose automatic coordinate detection in PCB using computer vision and neural networks.

Following is the proposed work due to limitations,

1. Compare database image of sample PCB with input image of PCB.
2. Extract features of difference areas.
3. To use neural network to train system
4. To detect missing component from given sample of soldered PCB using neural network

III.SYSTEM FLOW

There are unlimited applications for computer aided analysis systems and their popularities continuously increase. Computer imaging system can be used for sorting product, detecting defects, identifying internal and external characteristics of products and inspection of the equipment. The acquired digital image is transmitted to the computer processing module, to detect defect recognition module in computer. The specific detection processes is shown in figure

A. Image Acquisition:

The process of image acquisition involves images are automatically collected through the camera. This form of image acquisition in image processing is known as real-time image acquisition. This usually Real-time image acquisition creates a stream of files that can be automatically processed, queued for later work, or stitched into a single media format. The PCB images are taken by camera and further saved in computer.

B. Image preprocessing:

The images which are obtained during the process of image acquisition may not be suitable for identification of defects. PCB images are required to be preprocessed because it may contain unwanted backgrounds, poor resolution, weather conditions and different noises. Here firstly colored image is converted into HSV image and then HSV image is converted into binary image which is called as thresholding.

C. Feature Extraction:

Feature extraction a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. This approach is useful when image sizes are large and a reduced feature representation is required to quickly complete tasks such as image matching and retrieval. Feature detection, feature extraction, and matching are often combined to solve common computer vision problems such as object detection and recognition, content-based image retrieval, face detection and recognition, and texture classification.

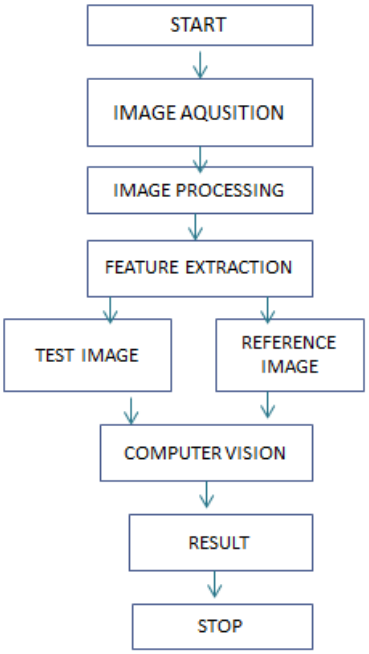

Fig.System Flow

RESULT

Here are the few results taken from the existing systems.

1) Results by using Automated vision inspections using embedded system[1]

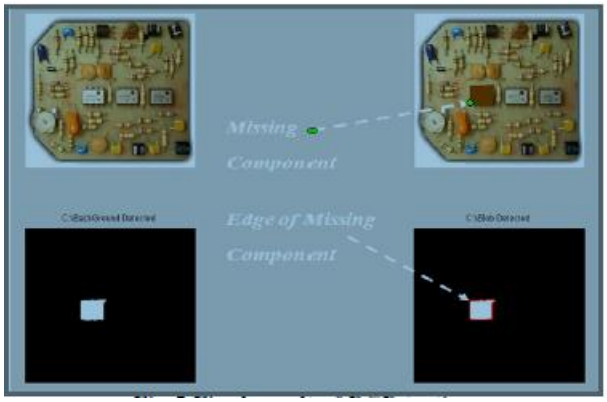

Fig: Results using embedded System

2) Results by using Neural Network.

The acquiring system uses a web camera that acquires the image of the bare PCB, while the Laptop system does the

image processing and post processing. About147 images are trained for neural network. Training dataset consists of 104 images and testing dataset also includes of 43 images. The experimental results have presented the back propagation neural network classifier using three features and 1000 iteration achieves the high recognition rate consists of 97.26 % for training and 97.23 % for testing [2].

Number	Number of Iteration	Layers	Training(%)	Testing (%)
1	300	[20,20,1]	37.05	36.18
2	500	[20,20,1]	95.08	93.20
3	1000	[20,20,1]	97.26	97.23
4	1000	[20,20,20,20,1]	92.20	90.29
5	2000	[20,20,1]	97.06	97.83
6	1000	[3,3,3,3,1]	96.95	96.82
7	1000	[5,5,1]	96.83	97.06
8	1000	[5,5,5,1]	96.89	96.81

Table 1.1: Results using Neural Network

3)Results by using two tempalate images and one defect image in this method, both images are subjected to image subtraction operation to produce an resultant image. XOR operator is applied to template image and the defective image separately to produce A1 image, respectively. In this metod testing for three different defective PCBs & then by increasing the noise level for each image seen that how much this method is capable to detect a faulty PCB & then graph is plotted b/w Noise level Vs Detection ratio. From there, the algorithms continue to produce the results[3].

Sr.No	NOISE LEVELS FOR PCB'S	SUC/ FAIL PCB 1	SUC/FAIL PCB2	SUC/FAIL PCB3
1	0.00001	S	S	S
2	0.00005	S	S	S
3	0.0001	S	S	S
4	0.0005	S	S	S
5	0.001	S	S	S
6	0.005	S	S	S
7	0.01	S	S	F
8	0.05	F	S	F
9	0.1	F	F	F
10	0.5	F	F	F

Table 1.2: Results using template image

4) Results by using Hybrid Genetic Algorithm using sobel technology.

6) Results by Bwlabel algorithm method [6].

Component	Jack 1	Jack 2	Angle(rad)
Safety Capacitor	(54.95,31.19)	(70.44,31.32)	0
Buzzer	(40.86,72.71)	(40.96,83.06)	1.56
Diode	(6.45,55.97)	(6.43,66.39)	-1.57
Relay	(40.95,47.70)	(41.08,63.59)	1.56

Table 1.3:Results by using Bwlabel method

CONCLUSION

Electronic products have placed on printed circuit boards (PCBs) for their construction for several decades and there is no reason to believe that this is likely to change in the foreseeable future. As Systems and PCBs become more complicated, with less physical access, the test model will need to look more like that of the IC. This paper surveys the various subsist methods of automatic PCB testing and the limitations still existing in this field.

REFERENCES

[1] Prof.Pallavi M. Taralkar , Prof.Swati D.Patil "Image Processing based PCB Component Detection",2018 International Journal of Scientific Research and Review

[2]Marzieh Mogharrebi, Anton Satria Prabuwono,Shahnorbanun Sahran, and Amirhossein Aghamohammadi, D. Zeng (Ed.): Advances in Electrical Engineering & Electrical Machines, LNEE 134, Verlag Berlin Heidelberg 2011

[3] Sonal Kaushik , Javed Ashraf, Automatic PCB defect detection using automatic PCB defect detection using ATIC PCB defect detection using Image subtraction method, International journal of computer science and network (ijcsn) Volume 1, issue 5, october 2012.

[4] Syamsiah Mashohor, Jonathan R. Evans and Ahmet T. Erdogan, Automatic Hybrid Genetic Algorithm Based Printed Circuit Board Inspection, Proceedings of the First NASA/ESA Conference on Adaptive Hardware and Systems (AHS'06) , IEEE, 2006.

[5] 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 – No.9, February 2014.

[6]. Jun-tao Xiong, Jin-zhao Li, Bao-xia Sun, Jian-guo Chen1, Study of Automatic PCB Jack Center Positioning System Based on Machine Vision, Published by Atlantis Press, 2013.