PCB Error Detection Using Image Processing

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Abstract- *Printed circuit boards are most common method of assembling modern electronic circuits. During the manufacturing of PCB many defects are accord which are harmful to circuit performance. There are different ways has been established to detect the defects found on PCB, but it is also necessary to classify these defects so that the source of these defects can be identified. The purpose system is to relieve human inspectors of the tedious and inefficient task of looking for those defects in PCBs which could lead to electric failure.*

Keywords*:* Printed Circuit Board, Image Subtraction, Defect Detection, ATMega-16 controller.

I. INTRODUCTION

Nowadays is necessary to improve the quality of PCB. In manufacturing industry there are defects, Misalignment and orientation error so automated inspection is required. The defects can be analysed by machine vision using algorithms developed for it. So machine vision provides a measurement technique for regularity and accuracy in the Inspection process. These systems have advantage over human inspection in which subjectivity, fatigue, slowness and high cost is involved. In recent years, the PCB industries require automation due to many reasons. The most important one is the technological advances in PCB's design and manufacturing. New electronic component fabrication technologies require efficient PCB design and inspection method with compact dimension. The complex and compact design causes difficulties to human inspection process. Another important factor is necessity to reduce the inspection duration. These factors lead to automation in PCB industry. Nowadays automated systems are preferred in manufacturing industry for higher productivity. Image subtraction is a kind of pixel subtraction process, where by the numeric value of one pixel or the complete image is subtracted from the image. The image subtraction operator takes two images as input and third image as output, whose pixel values are simply those of the first image minus the corresponding pixel values from the second image. Image subtraction method can be implemented on assembled PCBs, solder pasted PCBs. Solder joint inspection based on neural network combined with genetic algorithm had also been proposed. Authors had earlier implemented the image subtraction method to obtain the differences between the two images and classification of different defects. For the classification of the defects, the resultant difference image has been used. Image subtraction method can be combined with wavelets to reduce pixel value of image to detect the defects. The method had compared both the images pixel-by-pixel using XOR logic operator. The resulting image had shown only the defects.

II. PROPOSED SYSTEM

In this project we will make a system which will identify the defects on manufactured PCB. It involves finding missing components, incorrect mounting of components, components mounting in wrong position or any short circuit. We first compare a standard PCB image with a PCB image to be inspected, using image processing we can detect the defected regions.
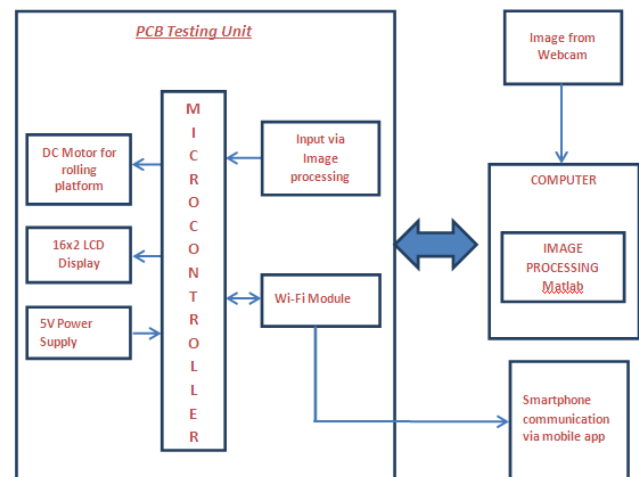
System Design

Fig.1 Block diagram

These system are divided into two units Hardware unit and Software unit. Hardware unit includes micro-controller, power supply section, display section, Wi-Fi Module. Software unit includes the compiler to build the embedded c program used in AVR microcontroller and Image processing using Matlab.

For our system we are using AVR ATmega16 microcontroller. It will control the movement of the rolling platform and will notify the testing status by sending data to LCD. Also it will handle the communication through laptop

and smart phone. Basically AVR microcontroller will act as a central controlling unit. The platform will be made with the help of a dc motor which will be control by microcontroller. DC motor will be control by motor driver IC L293D. Length of the platform will be around 4 feet so that at least four PCBs can be placed on it. So if any error will be found on PCB LCD give status about an error. It will also include a tray arrangement to separate the faulty PCB from the rest.

AVR Microcontroller

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The AVR is an 8 bit RISC single chip microcontroller with Harvard architecture that comes with some standard features such as on chip program ROM, data RAM, data EEPROM, timers and I/O ports. AVRs has some additional features like ADC, PWM and different kinds of serial interface such as USART, SPI, I2C, CAN, USB and so on.

LCD Display

A 16x2 LCD display will be used for notifying the status of the PCB testing. If no error found then it will display "Tested OK" and in case of some fault in PCB "ERROR" message will be displayed.

Wi-Fi Module

To make our system easier to handle we will be providing a mobile app so that user can control operation like On & Off from distant using smartphone. Also user can receive the status of testing like error on phone. For this system we are going to use EPS8266 Wi-Fi module.

Power Supply

It requires 5VDC power supply to operate DC motor and microcontroller. Also 3.3VDC is required to operate EPS8266 Wi-Fi module. So as per our need we will be designing a 5V and 3.3V DC power supply form 230VAC.

A step-down transformer is used to get 12V AC which is later converted to 12V DC using a rectifier. The output of rectifier still contains some ripples even though it is a DC signal due to which it is called as Pulsating DC. To remove the ripples and obtain smoothed DC power filter circuits are used. Here a capacitor is used. The 12V DC is rated down to 5V using a positive voltage regulator chip 7805. Thus a fixed DC voltage of 5V is obtained. Then regulator LM 317 will be used to convert 5V to 3.3 VDC.

III. CONCLUSION

PCB error detection is very important from the point of view of sales and ultimately success of any electronic product. The detection and classification results of proposed method are promising. Most of the defects like over and under itching, missing conductors break lines, wrong hole are successfully detected without any misclassification. The proposed method has some drawbacks like it require the same size of base and test images and it requires orientation of test image and base image. Future work can be done to overcome these drawbacks.

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