

Sorting Defective Detection

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Abstract:

An automated visual printed circuit board (PCB) inspection is an approach used to counter difficulties occurred in human's manual inspection that can eliminates subjective aspects and then provides fast, quantitative, and dimensional assessments. In this study, referential approach has been implemented on template and defective PCB images to detect numerous defects on bare PCBs before etching process, since etching usually contributes most destructive defects found on PCBs. The PCB inspection system is then improved by minimum thresholding technique and median filtering in order to solve alignment and uneven illumination problem. Finally, defect classification operation is employed in order to identify the source for two types of defects namely, missing hole, pin hole.

INTRODUCTION:

The design and development of reliable electronic system is highly challenging task. In this project we present the results of research carried out in order to improve the reliability of the printed circuit boards of a high reliability electronic consumer product manufactured locally by the application of accelerated interconnect stress testing by using Microscope.

Matlab process:

Image acquisition. In this study, real PCB images are captured using a high resolution 320 x 240 pixels UNIQ monochrome charged coupled device (CCD) camera. Height in between the CCD camera and the inspected PCBs is set to 15 cm as this is the highest available distance for the camera stand that can be set up such that CCD camera can grab the entire PCB images. A PC2-Vision frame grabber has been used to digitize and store the images into computer. Detection and classification algorithms are developed and tested in MATLAB 7.8.0 environment by employing Image Processing Toolbox, on Windows platform, with Pentium Intel® Core™ 2 personal computer, 1.86 GHz and 2 GB RAM (Random Access Memory).

Figure 3 shows the image acquisition system used in this research. Figures 4, 5, and 6 show the CCD camera, the PC2 vision frame grabber, and two bars of LED respectively used in this research.

Thresholding. In order to convert the positive and negative images to be binary, and eliminate noise on the images, threshold operation is executed to both images. Minimum thresholding technique is chosen. Threshold value, T is chosen such that $hT-1 < hT \leq hT+1$, where h is the number of pixels in the image with the certain gray-level. In this paper, threshold values, T , for the positive and negative images, are x and y , respectively. As a result, the thresholded positive and negative images are produced.

Filtering. The template of size 3 x 3 of median filter is employed to remove small noise in the both thresholded images.

Morphological processing:

In order to avoid the interference between the pixels and to calculate number of holes in PCB here we use image dilation operation and region boundaries in binary image.

Defect classification. Defect classification used is a combination of several image arithmetic and morphological operations that put at particular places in its algorithm.

External Interface:

Now MATLAB is connected to 8051 Controller to process the PCB separation depending on the decision taken by the MATLAB Image processing. Through serial communication using MATLAB external interface.

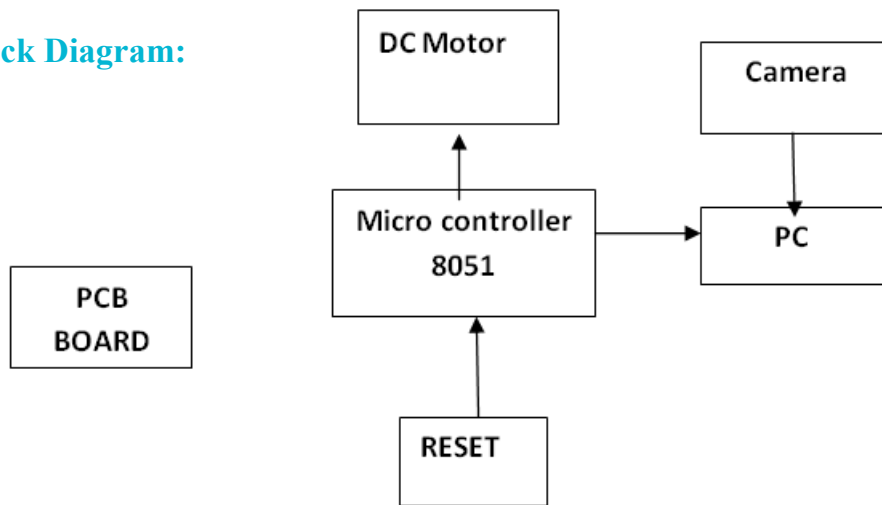
Description:

The development of printed circuit boards and the modular design concept in electronic system has lead to the widespread use of PCB's which are basically boards on

which electronic components are assembled. The reliability of the manufactured PCB is a function of both the reliability of the components used on the board and the reliability of the board itself. To develop this project we are using 8051 controller board, microscope, camera, PC. Printed Circuit Board is placed on a table. Above the board, a microscope is connected, by using a microscope clearly we can see board design for ex: if any hole is missed or line is not connected so on.

And for this module one camera is connected to take the image of the board and this image is sent to the PC. All testing will be done by using a Matlab application. Microcontroller acts as the heart of this project, which controls the whole system. It contains 1k RAM, 64k Flash, 3 Timers, 2 external interrupts, 1 UART, 32 GPIO's, ISP programming support etc. KEIL IDE is used to program the microcontroller and the coding will be done using Embedded C.

Block Diagram:



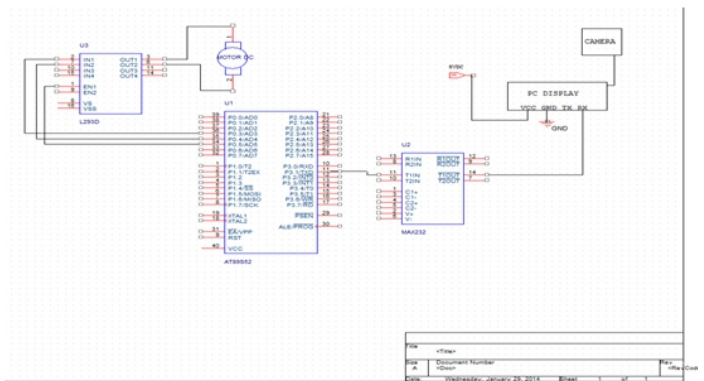
Code:

```

void delay(unsigned char);
void main(void){
uart_init();
while(1) {
if(SBUF==2)
{
h1=1; h2=0;
delay(500); delay(500);delay(500); delay(100);
h1=1; h2=1; g=0;
}
}
if(SBUF==3)
{
h1=0; h2=1;
delay(500); delay(500); delay(500); delay(100);
h1=1; h2=1; n=0; } } }

void delay(unsigned char value)
{
unsigned int i,j;
for(ii=0;ii<value;ii++)
for(j=0;j<125;j++);
}
  
```

Schematic Diagram:



DC Motor Connections:

Figure shows schematically the different methods of connecting the field and armature circuits in a DC Motor. The circular symbol represents the armature circuit, and the squares at the side of the circle represent the brush commutator system. The direction of the arrows indicates the direction of the magnetic fields.

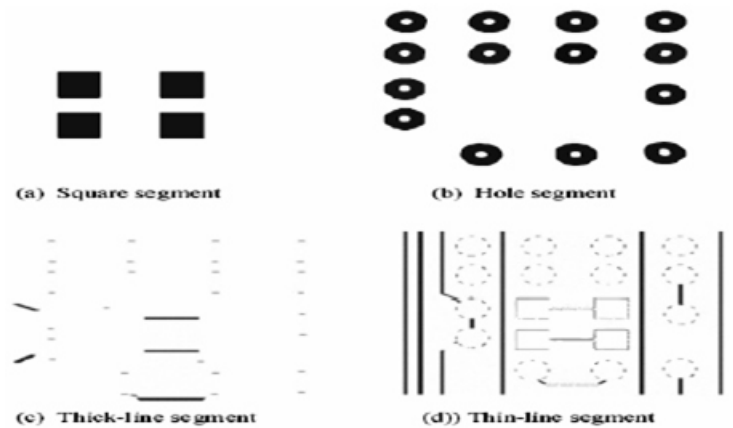
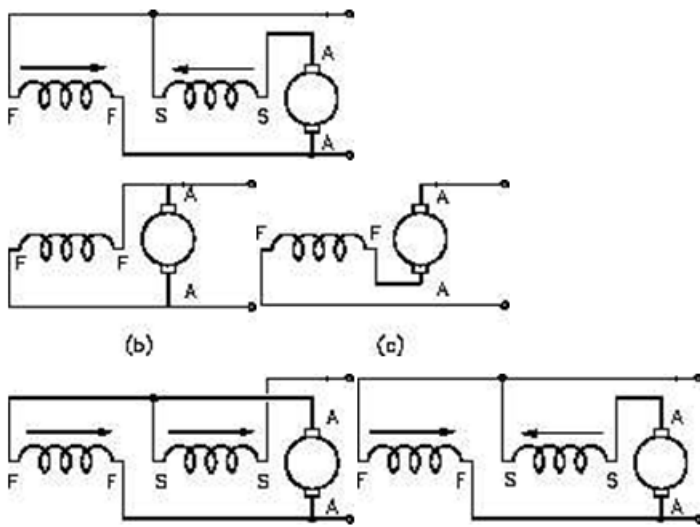


Fig. 1 Morphological Segmentation for Template Image

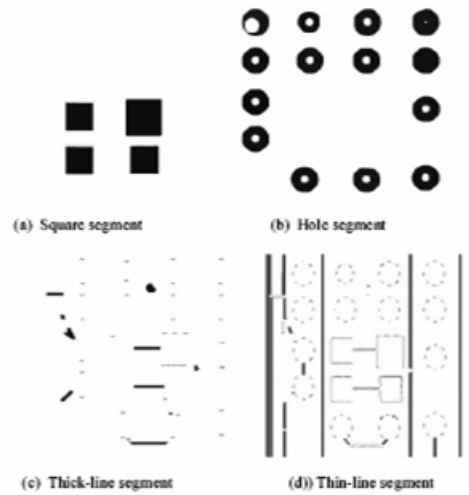
Methodology:

Printed circuit defects are mainly missing or extraelements on the board. PCB defects can be categorized into two groups; functional defects and cosmetic defects. Functional defects can be fatal to the circuit operation while cosmetic defects affect the appearance of the circuitboard but may affect the performance of the circuit in longterm.

The PCB manufacturing process is based onchemical and mechanical actions that may damage theintended design. Frequently, various PCB defects such asbreak out, pinhole, open-circuit, under-etch and mousebiteoccurred during production. Computer generated printed circuit board images absentfrom any defects, known as Template Images are designedas control images to compare with the circuit that containsdefects.

Anyanomalies between Template and Test Image are declaredas defects. InderaPutera classified these defects into sevengroups. Based on reviews of previous works, Heriansyahdevelop a PCB image segmentation algorithm to separatePCB images into four main segments which are squaresegment, hole segment, thin line segment and thick linesegment using mathematical morphology and windowingtechnique.

Morphological process involves techniques such asdilation, erosion, opening and closing which helps inpartitioning the images and associates certain types ofdefects with certain patterns. Refer to Figure 1 for anexample of PCB image segmentation



Softwares used:

- 1.Embedded C
- 2.Keil Compiler
- 3.Flash Magic
- 4.MATLAB

Real time Example :

KHO-KHO: Kho-Khois to Catch by pursuit and to chase the defect or waste in the process.

Chaser:

- Chaser is a 7 Quality Tools & 5S /6S
- Histogram
- Run Chart
- Control Chart
- Scatter Plot
- Pareto Chart
- 5-whys

Fish Bone -Root Cause

Kaizen 5s/6s:

Sorting, Setting, Shining, Standardization, Sustain



Runner: Runner is a DOWNTIME i:e (Defect, Over production, waste, non-utilization of Talent, Invoice, Extra Process)

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