User Solution: Printed Circuit Board (PCB) Automated Inspection System

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A leading New Zealand manufacturing company contracted NVSI to provide a flexible and cost effective vision-based non-destructive method of detecting course defects on various populated Printed Circuit Boards (PCBs).

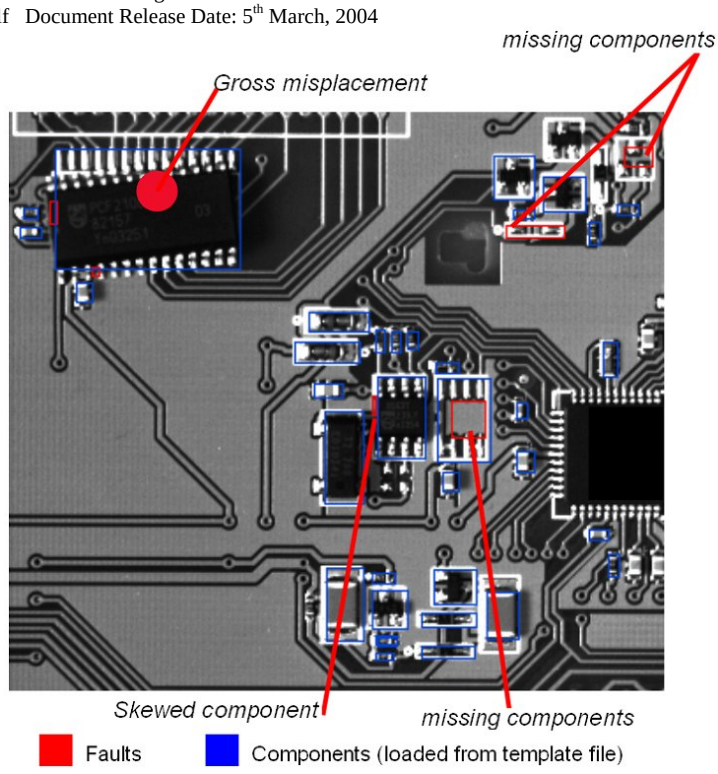
The Solution

NVSI created a proof of concept software package that performed vision analysis using low cost, commercially available technology. This included networking, IEEE-1394 (Firewire™) cameras and the National Instruments NI-1455 Compact Vision System.

The system was comprised of two parts: an *Embedded PCB Inspection System (EPIS)* and an *Interactive Terminal PC (ITP).* The EPIS vision analysis software executes on the National Instruments Compact Vision System (NI-1455), a real time (Pharlap) target with 3x IEEE1394 (FireWire™) buses, and FPGA technology. The code was developed in the LabVIEW RT development environment on a standard PC, and easily embedded into the NI-1455. Image normalisation and comparison tools developed by NVSI and National Instruments are the key software components enabling the system to work effectively. The ITP is a standard industrial PC that displays a user interface, enabling the user to control and configure the EPIS. The ITP also shows the unit under test (UUT), and any detected faults, prompting the user to mark the suspect UUT for further evaluation before the WIP continues along the production workflow.

Inspection is carried out on post reflow or post wave boards to ascertain coarse defects and missing components to a tolerance of half the smallest component present. The faults detected included:

- Missing components (presence/absence)
- Gross misplacement or positioning errors
- Skewed components
- Tombstones



The algorithm used by this solution does not use pattern matching techniques, as these are often quite slow, and error prone. Rather than search for small component image templates, the NVSI system first performs an optimised proprietary differential algorithm to detect gross erroneous component placement, and then a further fine technique, based on raw component templates from either a CAD or database file used during the PCB population design phase.

Conclusion

The client was provided with a completely customised software solution that proves that defects can be identified rapidly. Due to the inclusion of existing component file parsing, this solution can potentially decrease the training time for a new PCB dramatically.

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