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## Patent Search

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### Abstract:

The present disclosure relates to systems and methods and provides an automated PCB defect detection system (100) for detecting defects in printed circuit boards, to provide accurate, real-time detection and classification of PCB defects and to be effectively integrated into manufacturing quality inspection systems. The automat defect detection system (100) includes an image acquisition module (102), a dataset and annotation module (106), and a labeled dataset (108) annotated with boundi and defect class labels. The automated PCB defect detection system (100) is configured to provide accurate, real-time detection and classification of PCB defects in re continuous operation during the manufacturing process. This configuration achieves enhanced accuracy, speed, and reliability of PCB inspection processes within ele manufacturing environments.

**Complete Specification**

Description: TECHNICAL FIELD

[001] The present invention relates to the field of electronics manufacturing and quality inspection systems, and more particularly to computer vision-based automated optical inspection systems for Automated PCB Defect Detection in printed circuit boards using deep learning models, specifically the YOLOv8 object detection framework.

BACKGROUND

[002] The field of electronics manufacturing and quality inspection has seen significant development in recent years. Printed circuit boards are fundamental components of modern electronic devices, providing mechanical support and electrical interconnections for electronic components. As electronic products become increasingly complex and complex, printed circuit board designs incorporate higher component densities and finer trace widths, rendering them more susceptible to manufacturing defects. Such defects may arise during fabrication and assembly processes and may include missing components, misaligned components, short circuits, open circuits, solder bridges, insufficient solder, spurious copper, and surface scratches, each of which may significantly affect product performance, reliability, and operational safety.

[003] Traditionally, printed circuit board inspection has been carried out using manual visual inspection conducted by trained operators. In manual inspection process, a human inspector examines each board visually or under magnification to identify surface-level anomalies. Such methods are inherently limited by operator fatigue, subjective judgment, and practical constraints on inspection throughput. As production volumes increase and board complexity grows, the reliability and scalability of manual inspection may degrade substantially, resulting in elevated rates of missed defects and increased product rework or rejection costs.

[004] Conventional automated optical inspection systems have been developed to address some of the limitations of manual inspection. These systems typically rely on rule-based image processing techniques, such as thresholding, edge detection, template matching, and morphological operations, to compare captured board images against reference templates or predefined defect models.

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