

**RANCANG BANGUN SISTEM INSPEKSI VISUAL BERBASIS YOLO
UNTUK DETEKSI CACAT STEPNOSING**

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PADANG

2025

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ABSTRAK

Stepnosing merupakan komponen penting pada tangga yang berfungsi meningkatkan keselamatan dan estetika, sehingga kualitas produk menjadi faktor krusial. Pada praktiknya, proses inspeksi stepnosing di industri masih dilakukan secara manual dengan metode sampling, yang rawan menimbulkan kesalahan dan memungkinkan produk cacat tetap lolos ke pasaran. Penelitian ini bertujuan merancang sistem inspeksi visual otomatis berbasis *You Only Look Once* (YOLO) untuk mendeteksi cacat stepnosing secara real-time. Sistem dikembangkan menggunakan perangkat Jetson Nano, kamera Logitech C270 sebagai akuisisi citra, serta monitor sebagai antarmuka visual. Dataset yang digunakan terdiri atas citra stepnosing cacat dan normal yang telah melalui proses augmentasi, termasuk penambahan variasi latar belakang. Model YOLOv5 dilatih dan diuji dengan hasil *Precision-Recall curve* sebesar 0,995 dan tingkat kesalahan hanya 2% dari keseluruhan pengujian. Sistem mampu menampilkan hasil inspeksi melalui visualisasi *bounding box* dan *edge detection*, serta memberikan notifikasi instan dengan buzzer apabila ditemukan cacat. Hasil ini menunjukkan bahwa sistem yang dirancang efektif dalam mengurangi kesalahan inspeksi manual, meningkatkan konsistensi kualitas produk, dan memiliki potensi untuk diimplementasikan di industri manufaktur stepnosing.

Kata Kunci: stepnosing, inspeksi visual, YOLOv5, *edge detection*, real-time

DEVELOPMENT OF A YOLO-BASED VISUAL INSPECTION SYSTEM FOR STEPNOSING DEFECT DETECTION

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ABSTRACT

Stepnosing is an essential component of stair structures that serves to improve both safety and aesthetics, making product quality a critical factor. In practice, the inspection process in the stepnosing industry is still carried out manually using sampling methods, which are prone to errors and allow defective products to enter the market. This study aims to design an automated visual inspection system based on *You Only Look Once* (YOLO) to detect stepnosing defects in real-time. The system was developed using Jetson Nano as the processing unit, a Logitech C270 camera for image acquisition, and a monitor as the visual interface. The dataset consisted of defective and non-defective stepnosing images, which underwent augmentation including background variations. The YOLOv5 model was trained and tested, achieving a *Precision-Recall curve* of 0.995 and an error rate of only 2% across all tests. The system can display inspection results through *bounding boxes* and *edge detection* visualization, and provides instant notifications via a buzzer when defects are detected. These results demonstrate that the proposed system is effective in reducing manual inspection errors, enhancing product quality consistency, and has strong potential for implementation in the stepnosing manufacturing industry.

Keywords: stepnosing, visual inspection, YOLOv5, *edge detection*, real-time