RANCANG BANGUN SISTEM IDENTIFIKASI PRODUK CACAT PADA *FOLDING BOX* BERBASIS YOLOv8m YANG TERINTEGRASI DENGAN *REJECTION AREA*

SKRIPSI

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar Sarjana Teknik Program Studi Mekatronika dan Kecerdasan Buatan

Oleh:
Agung Satria Pamungkas
2104773

PROGRAM STUDI MEKATRONIKA DAN KECERDASAN BUATAN
KAMPUS UPI DI PURWAKARTA
UNIVERSITAS PENDIDIKAN INDONESIA
2025

LEMBAR HAK CIPTA

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Oleh:

Agung Satria Pamungkas

Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Teknik pada Program Studi Mekatronika dan Kecerdasan Buatan

LEMBAR PENGESAHAN

AGUNG SATRIA PAMUNGKAS

2104773

RANCANG BANGUN SISTEM IDENTIFIKASI PRODUK CACAT PADA *FOLDING BOX* BERBASIS YOLOv8m YANG TERINTEGRASI DENGAN *REJECTION AREA*

disetujui dan disahkan oleh pembimbing:

Pembimbing I,

Dewi Indriati Hadi Putri, S.Pd., M.T
NIP. 920190219900126201

Pembimbing II,

Diky Zakaria, S.Pd., M.T
NIP. 920211019931203101

Mengetahui,

Ketua Program Studi Mekatronika dan Kecerdasan Buatan

Dewi Indriati Hadi Putri, S.Pd., M.T
NIP. 920190219900126201

Rancang Bangun Sistem Identifikasi Produk Cacat pada *Folding Box* berbasis YOLOv8m yang Terintegrasi dengan *Rejection Area*

Agung Satria Pamungkas
2104773

ABSTRAK

Industri manufaktur kemasan memerlukan sistem *quality control* yang cepat, akurat, dan efektif untuk menjaga kualitas produk. Penelitian ini merancang dan mengintegrasikan prototipe sistem produksi dengan algoritma deteksi cacat berbasis YOLOv8m. Sistem terdiri dari enam area: *folding box placement*, *image acquisition*, *rejection*, *good folding box*, *computerization*, dan *air compression*. Dataset tiga kategori (normal, robek, terlipat) diperoleh dari pengambilan gambar pada variasi ketinggian kamera, dianotasi menggunakan *instance segmentation*, dan diperluas dengan *data augmentation*. Model dilatih 50 *epoch* di Google Colab dan dievaluasi dengan akurasi, presisi, *recall*, mAP, dan *F1-score*. Metode dengan *augmentation* mencapai akurasi 0,906, presisi 0,964, *recall* 0,962, dan mAP 0,977, melampaui metode tanpa *augmentation*. Integrasi dengan sistem *rejection* memungkinkan deteksi dan pemisahan *folding box* cacat secara *real-time* tanpa intervensi manual, dengan FAR dan FRR rendah. Sistem stabil pada ketinggian kamera 30 cm maupun 40 cm dengan jarak antar *folding box* 20–35 cm. Penelitian ini menyimpulkan bahwa kombinasi *hardware* terintegrasi dan YOLOv8m menjadi solusi efektif untuk otomasi identifikasi produk cacat pada *folding box* di industri kemasan.

Kata kunci: YOLOv8m, *quality control*, deteksi cacat, *folding box*, *instance segmentation*.

Design and Development of a Defective Product Identification System for Folding Box Based on YOLOv8m Integrated with a Rejection Area

Agung Satria Pamungkas
2104773

ABSTRACT

The packaging manufacturing industry requires a fast, accurate, and effective quality control system to maintain product standards. This study designed and integrated a production system prototype with a defect detection algorithm based on YOLOv8m. The system comprises six areas: folding box placement, image acquisition, rejection, good folding box, computerization, and air compression. A three-category dataset (normal, torn, folded) was obtained through image capture at varying camera heights, annotated using instance segmentation, and expanded via data augmentation. The model was trained for 50 epochs in Google Colab and evaluated using accuracy, precision, recall, mAP, and F1-score. The augmented method achieved 0.906 accuracy, 0.964 precision, 0.962 recall, and 0.977 mAP, outperforming the non-augmented method. Integration with the rejection system enabled real-time detection and removal of defective folding boxes without manual intervention, with low FAR and FRR. The system was stable at camera heights of 30 cm and 40 cm with box spacing of 20–35 cm. This study concludes that the combination of integrated hardware and YOLOv8m provides an effective solution for automating defect identification of folding boxes in the packaging industry.

Keywords: *YOLOv8m, quality control, defect detection, folding box, instance segmentation.*

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