คณะวิศวกรรมศาสตร์ Faculty of Engineering

PROJECT DAY 2026 FACULTY OF ENGINEERING

INC26

Chain Counter and AI Defect Inspection System

CONTROL SYSTEMS AND INSTRUMENTATION ENGINEERING PROGRAM

Mr Kittitat Rakboua   Mr Kunanun Sawadmoon   Mr Teetut Kudeesri

Advisor : Dr.Witchuda Thongking

INTRODUCTION

In industrial manufacturing, chain inspection is an essential procedure to guarantee the dependability and quality of the final product. Conventional manual inspection takes a lot of time and is prone to human mistake, particularly when it comes to repeated activities like counting chain links and finding minor flaws.This project suggests an automated inspection system that counts chains and detects defects in real time using deep learning and computer vision techniques. Through a web-based interface, the system seeks to increase inspection accuracy, decrease reliance on manpower, and offer effective monitoring.

OBJECTIVE

1. To develop a real-time chain counting and defect detection system using YOLOv8
2. To design a mechanical system for consistent chain movement
3. To display inspection results through a web-based dashboard
4. To improve inspection accuracy and reduce human error in chain inspection processes.

METHODOLOGY

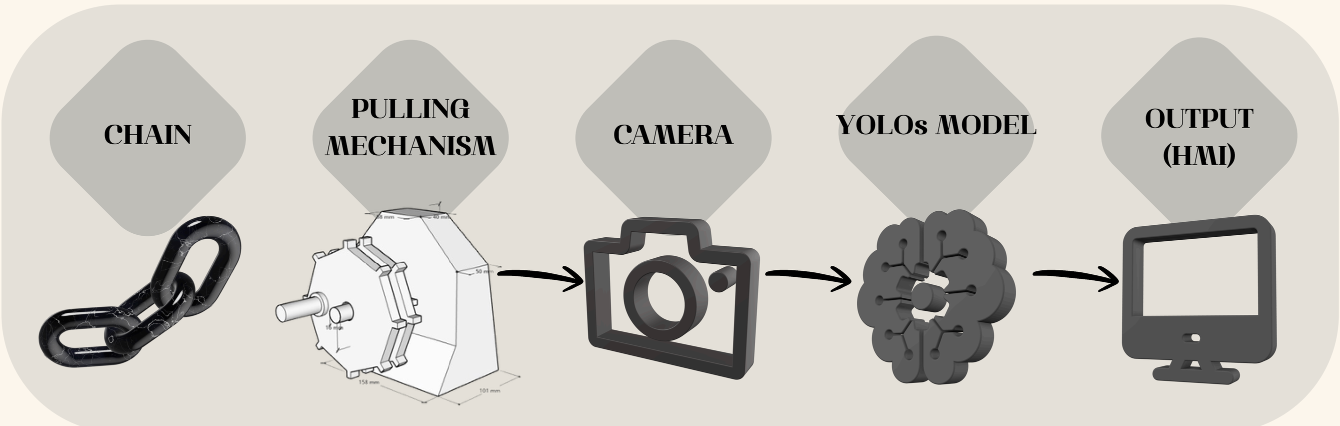

Figure 1: System overview of the chain counting and inspection process.

1. Hardware Design & Prototyping
Design and prototype a pulling machine with an integrated high-resolution camera for real-time chain image capture and defect detection.
2. Model Training
Train a YOLOv8 model on the dataset to:
- Classify defect types
- Detect and localize individual chain links

3. System Integration & Deployment
Integrate the trained model with a web dashboard that connects to the pulling machine, enabling real-time monitoring of chain quality, detected defects, and link counts.

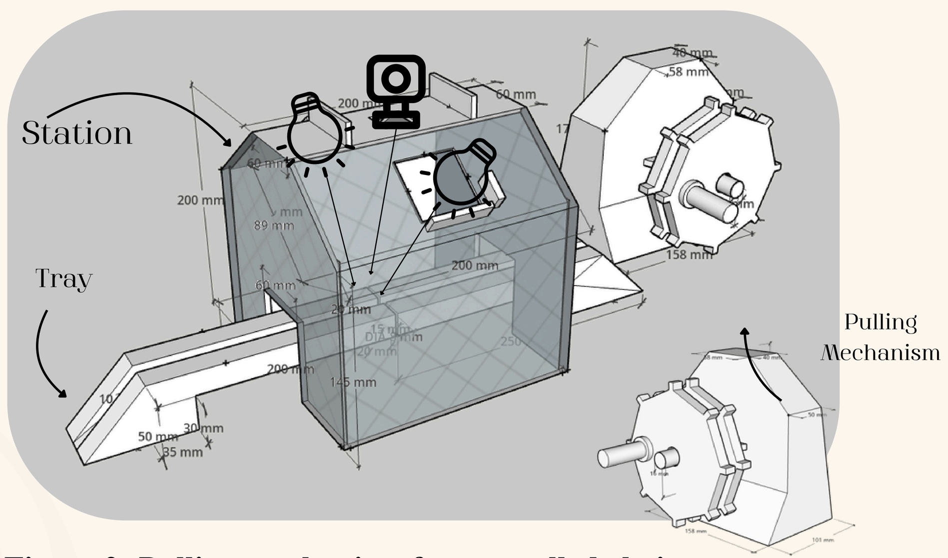

Figure 2: Pulling mechanism for controlled chain movement.

The YOLOv8 model detects multiple classes (chain links and defects) using bounding boxes for localization and classification for defect types, with confidence scores for each detection. Chain count, defects, and system status are displayed in real time via a web interface, while a dashboard and tables store inspection data for further analysis.

Parameter Model : Yolov8n. Image size : 640 Batch. 16 Epoch 50. Learning rate 0.1.


Figure 3: Prototype of the automated chain inspection system.

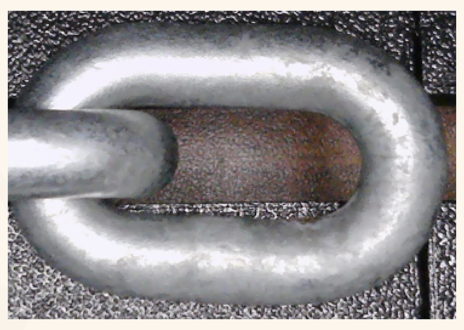
Figure 4: Chain surface samples for defect analysis.

RESULTS

Detection Results

Using bounding boxes, the system effectively detects and counts chain links in real time with high precision and recall. Chain link defects are accurately recognised and classified across a variety of illumination conditions, demonstrating the robustness of the trained model under practical inspection environments.

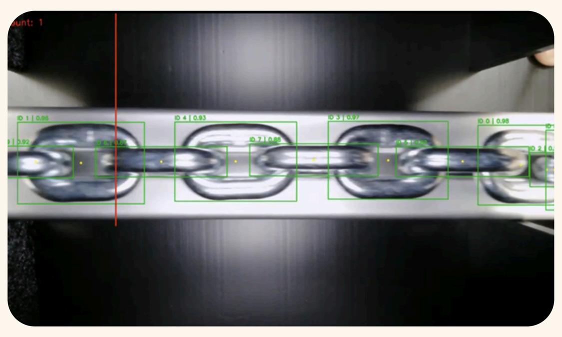
Figure 5: Chain counting using bounding boxes.

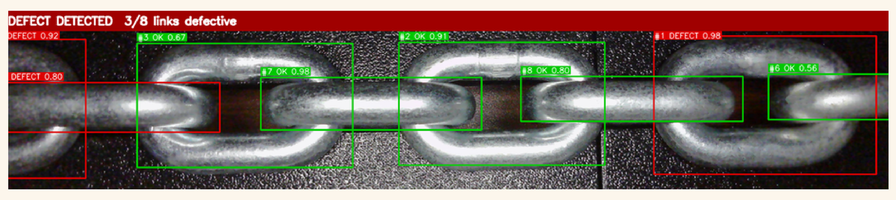

Figure 6: Defect detection on chain surface.

Performance (Counting)

Precision	Recall	Accuracy	mAP50-95
98.2%	99.9%	99.5%	72.6%

Performance (Inspection)

Precision	Recall	Accuracy	F1 Score
56.7%	63.0%	77.7%	59.6%

Web Visualization

Real-time monitoring and visualization of inspection results are made possible by the created online interface. Through the dashboard, users may monitor system performance, examine identified flaws, and retrieve previous inspection results.

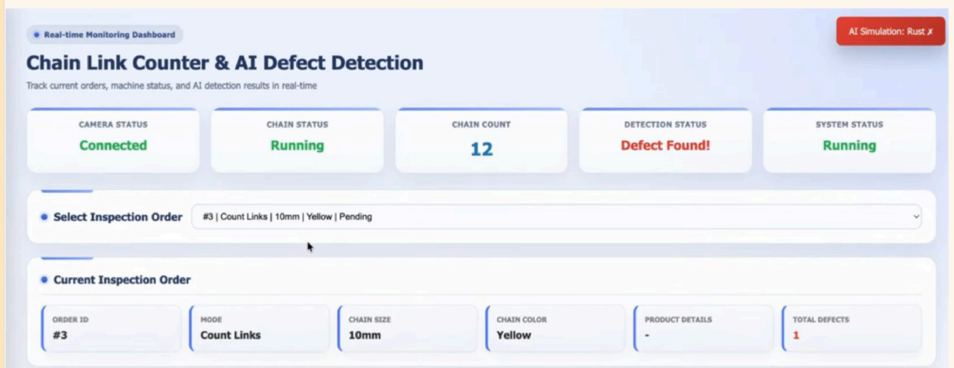

Figure 7: Web interface displaying inspection results.

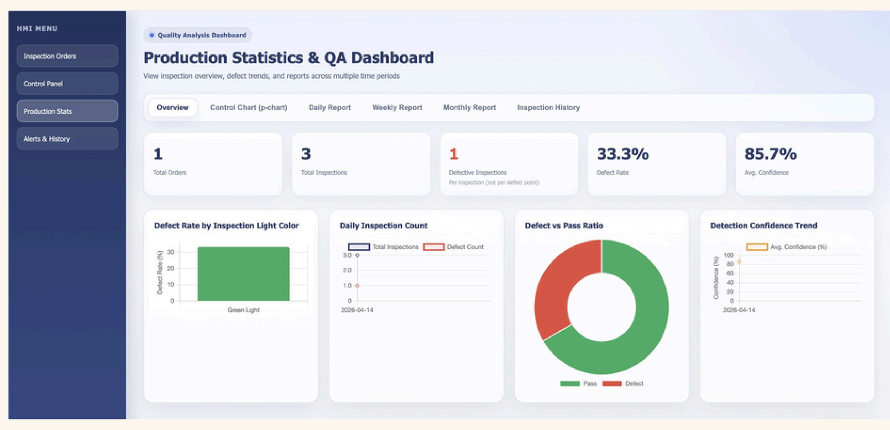

Figure 8: Dashboard for real-time monitoring.

Chain counting, detection confidence, and a live video feed are among the real-time system monitoring features offered by the output interface. A dashboard that displays important metrics like defect rate and control charts is used to store and display inspection data. Daily, weekly, and monthly versions of historical data are available.

CONCLUSION

This project successfully developed an automated chain inspection system integrating YOLOv8-based computer vision for real-time link counting and defect classification. The link counting module employs a line-crossing method, demonstrating high counting accuracy with strong precision and recall performance. The defect detection module identifies defect classes in live camera footage, with moderate classification accuracy that reflects the constraints of a limited training dataset. Inspection results are presented through a four-page HMI dashboard, replacing manual inspection with a consistent, repeatable, and data-driven process. Future development will focus on expanding the annotated defect dataset, enabling GPU-accelerated inference, and integrating the system into a conveyor-based production line for full industrial deployment.

REFERENCE

[1] C. W. Tan, J. M. A. Pacaldo, W. P. Lee, G. J. Tan, S. L. Wong, and J. K. Chaw, “Automated Metal Surface Defect Detection,” in Lecture Notes of the Institute for Computer Sciences, 2023,

[2] R. Nascimento, T. Ferreira, C. D. Rocha, V. Filipe, M. F. Silva, G. Veiga, and L. Rocha, “Quality Inspection in Casting Aluminum Parts: A Machine Vision System for Filings Detection and Hole Inspection,” Journal of Intelligent & Robotic Systems, vol. 111, p. 53, 2025,

[3] H. N. Al-Jubori and I. Al-Darraji, “Tools and Process of Defect Detection in Automated Manufacturing Systems,” EAI Endorsed Transactions on Scalable Information Systems, 2023,