Proceedings of the 4th Australian Conference on Industrial Engineering and Operations Management
Melbourne, Australia, November 25-27, 2025

Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/AU04.20250042
Published: November 25, 2025

A Conceptual Framework on AI-Driven Predictive Maintenance System on Conveyor Belt Systems in the Food Processing and Beverage Manufacturing Industry

Aurora Takendu and Kamalakanta Muduli
School of Mechanical Engineering
Papua New Guinea University of Technology
Papua New Guinea
22301175auta@student.pnguot.ac.pg

Abstract

This paper discusses a potential framework for an AI-driven predictive maintenance system that can be able to detect belt misalignments in conveyor belt systems in the food and beverage manufacturing industry. In the fast-moving consumption goods (FMCG) sector, conveyor belt systems are important for efficient and safe production, but they often experience unplanned breakdown due to belt drift or misalignment. This can lead to downtime and safety risks. To address this, this research paper proposes an AI approach that combines sensor monitoring, data preprocessing, and predictive modelling using AI models. A sample dataset from Kaggle, a public data library, was used study key parameters such as vibrations, motor current, load, and belt tension. A random forest classifier was used as a proof of concept, predicting misalignment events with 88% accuracy, 85% precision, and 86% recall. The framework has five main layers; data collection, data preprocessing, AI model interface, performance evaluation, and decision support. So even without using real-time industrial data, the results show that AI-based predictive maintenance is feasible in resource-limited settings like Papua New Guinea. This framework offers a practical basis for local industries to reduce unplanned downtime, improve overall production efficiency and take the first step to Industry 4.0.

Keywords
AI-Driven, Conveyor, Framework, Predictive Maintenance, Random Forest