AI-Powered PQRS Automation for Faster, More Accurate Cigarette Quality Inspections

ABOUT THE CLIENT

A global leader in cigarette manufacturing From US — wanted to update and automate its Product Quality Rating System (PQRS).

The company is often involved in huge volume production and uses manual labor for quality inspection, and wanted to find a better way of experiencing faster, more accurate and standardized quality inspections.

OVERVIEW

The PQRS process plays a vital role in continuing to deliver cigarettes and packets that meet the significant established quality standard for the brand. The inspection process was previously conducted by visually inspecting for 150+ discriminating defects on a cigarette.

This made for a lengthy process that had high human error potential. The customer engaged Vionsys to automate and eventually replace this antiquated process with an AI-powered, real-time, and data-build quality inspection system, suited to the scale of the customer, could deliver real-time quality inspections, and generate actionable insights for the brand management.

CHALLENGES

- Manual Inspection Dependency: Quality inspectors had to visually assess 150+ possible defects on individual cigarettes and packets, which was slow and exhausting.
- Time-Consuming Process: Each inspection cycle took longer than desired, limiting throughput and efficiency.
- Lack of Standardization: Variations in human judgment led to inconsistencies in defect detection.
- No Centralized Data or Reports: The absence of automated logs and dashboards meant management lacked timely visibility into defect trends and compliance metrics.

SOLUTION

- AI-Powered Defect Detection: Leveraging YOLO, TensorFlow, and PyTorch, the system could automatically detect defects in real time using mobile devices and camera feeds.
- Standardized Inspection Logs: Automated logs aligned with PQRS protocols were generated instantly for each batch inspected.
- Advanced Analytics & Reporting: A ChatGPT-powered interface enabled managers to run comparative analyses, generate reports, and query defect trends conversationally.
- Seamless Integration: Built with LangChain, OpenAI APIs, and Hugging Face, and deployed via Flask, the solution fit seamlessly into the customer's existing inspection infrastructure.

IMPACT

- Fully Automated & Standardized Inspections: Eliminated variations caused by human judgment.
- Real-Time Defect Classification: Instant detection allowed for immediate corrective actions.
- Centralized Data Visibility: Unified dashboards provided live insights across all inspection points.
- Improved Compliance: Consistently adhered to PQRS protocols without manual intervention.

TECHNOLOGY STACK

- Machine Learning & Deep Learning: YOLO, TensorFlow, PyTorch
- AI & LLM Integration: LangChain, OpenAI APIs, Hugging Face
- Framework & Deployment: Flask
- Conversational Analytics: ChatGPT-powered interface

RESULTS

- Inspection time was reduced by more than 60% from previous manual processes.
- Defect inspection accuracy was nearly 100% consistent on all production lines.
- Autonomous data provided management with data-backed intelligence to enforce quality improvements through proactive, predictive adjustments to the production processes.
- Production efficiencies were optimized while the product still complied with operational quality requirements.

CONCLUSION

- As a result of their work with Vionsys, the customer transitioned from a manual-heavy, error-prone inspection process to an intelligent automated PQRS system.
- The AI-based process enabled faster identification and review of defects, as well as data intelligence and historical information for the customer's management team — an approach that allowed them to set an all-new standard of quality control in cigarette manufacturing.