Amrood labs

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Overview

Exacto is an enterprise IoT edge intelligence platform built for manufacturing teams that need faster, more reliable quality inspection across production lines. Before this, inspections entirely depended on manual methods, disconnected inspection records, and time-consuming reporting. It was very difficult to detect the defects early.

Amrood Labs delivered a centralized quality inspection platform that unified edge devices, IP cameras, PLCs, ML model deployment, real-time monitoring, inspection results, reporting, user access, and audit logs into one system. The platform was built to support both cloud and on-premise storage, multi-camera setups, and regulated manufacturing environments.

The rollout created measurable improvements: inspection coverage increased to 100% of production cycles, device setup moved from multi-day manual configuration to one guided session, inspection records became searchable in seconds, and quality reporting shifted from weekly manual summaries to live dashboards.

Company Background

Exacto serves manufacturing organizations that rely on production-line quality checks to detect defects, verify the accuracy of different parts, and maintain stable compliance. These teams often work with multiple devices, camera types, PLC systems, part numbers, and inspection models across different production stations.

To scale quality control, the company needed a reliable system that could connect factory hardware with AI inspection workflows while keeping inspection data easy to monitor, search, report, and audit.

Problem Statement

Exacto's challenges were often seen as hardware and inspection issues, but the deeper problem was operational: quality teams lacked one connected system for device setup, live inspection, data tracking, and reporting.

1. **Mixed factory hardware and protocols:** Manufacturing floors used different cameras, edge devices, communication protocols, and PLC standards, making setup difficult to manage consistently.
2. **Manual device configuration:** Device onboarding required technical work, manual scripts, and repeated steps, which slowed deployment and increased configuration errors.
3. **Real-time inspection visibility:** Teams needed inspection results to appear as soon as they happened on the line, without waiting for delayed syncs or manual reports.

4. **Large inspection data volume:** Production lines generated huge amounts of cycle data, images, timestamps, model outputs, and pass/fail records that were difficult to search through normal tools.
5. **ML model deployment control:** The right trained model had to be linked to the right device, camera, and part number without disrupting active production.
6. **Multi-camera coordination:** A single edge device could run up to six cameras, each with its own settings, image format, and region of interest.
7. **Compliance and audit needs:** Manufacturing QA required full logs for user actions, overrides, device updates, and inspection history.
8. **Flexible storage requirements**: Some customers required cloud storage, while others needed on-premise storage for data control.

Proposed Solution

We built a centralized IoT edge intelligence platform designed around a simple workflow: onboard devices, configure inspection, run production monitoring, capture results, and report outcomes.

Key modules included:

- **Device Onboarding:** A guided setup flow for registering edge devices, testing IP connectivity, configuring cameras, assigning ML models, and saving system configuration.
- **Real-Time Production Monitoring:** A live dashboard for operators to view inspection images, pass/fail results, First Pass Yield, production mode, and failure notifications.
- **Admin Dashboard & Analytics:** Management-level dashboards showing total inspected parts, pass/fail results, FPY trends, and performance charts across devices, models, and time ranges.
- **ML Model Library:** A central place to upload, version, update, and deploy trained ML models to the correct devices and part numbers.
- **Part & Product Management:** Product and part-number management that connects physical parts to inspection models, production results, and quality trends.
- **Device Management:** A post-onboarding control center for monitoring device status, updating configurations, checking sync health, and managing active/inactive devices.
- **Inspection Results & Reporting:** A searchable inspection history with filters, production context, PDF exports, and compliance-ready records.
- **User & Access Management:** Role-based access for admins, and technicians, with complete audit logs and controlled permissions.

- **System Health & Monitoring:** Monitoring for device connectivity, sync status, data transfer, background jobs, and real-time dashboard state.

Implementation

The platform was implemented as a modern web-based inspection management system that is connected to factory infrastructure.

Frontend: Next.js, React, TypeScript, and Tailwind CSS were used to build a responsive dashboard for operators and managers.

State Management: Redux Toolkit and Redux Persist helped maintain inspection and configuration state across sessions.

Backend: Next.js API routes handled platform logic, device configuration, user access, and reporting workflows.

Data: PostgreSQL with Prisma managed structured inspection, device, user, model, and audit data.

Search: Apache Solr was added to support fast searches across large volumes of inspection records.

ML Inference: A Python Flask inference API connected edge inspection workflows with trained ML models.

Real-Time Updates: Socket.io, WebSockets, and short polling kept production dashboards updated during active inspection.

Files & Reports: Multipart file handling supported model uploads, while PDF exports supported reporting and audit reviews.

Automation: Cron jobs managed background sync between edge devices and the admin system.

Deployment: Docker, Docker Compose, and Caddy supported production deployment with SSL/TLS termination.

Backups: Automated hourly database backups with seven-day retention improved operational safety.

Results

After rollout, Exacto improved inspection coverage, device control, reporting speed, and quality visibility across manufacturing operations.

Metric	Before	After	Change
Inspection coverage	Manual spot sampling	Every production cycle inspected automatically	100% coverage
Device setup	Multi-day manual configuration	Guided onboarding in one session	Faster commissioning
Defect detection	Often caught at downstream quality gates	Caught at point of manufacture	Earlier detection
Result search	Spreadsheet lookups taking minutes	Solr-powered search in seconds	Faster access
ML deployment	Manual file transfer per device	Centralized, version-tracked deployment	Fewer errors
Quality reporting	Weekly manual summaries	Live dashboards by time range	Real-time visibility
Compliance audit	Manual log reconstruction	Built-in audit logs and PDF exports	Easier audits
Multi-camera setup	Individual scripts per camera	Up to 6 cameras in one unified form	Simpler setup
Data sync	Manual export/import	Automated background sync	Less admin work

Additional business impact reported through the platform:

- Quality teams moved from sampled inspections to full production-cycle visibility.
- Operators could monitor live pass/fail results without manual data collection.
- Management gained instant access to FPY trends by shift, part number, model, and device.
- Compliance teams could prepare audit records directly from the platform.
- Device and model updates became easier to manage remotely, reducing on-site support needs.

Analysis

Effective Outcomes

Real-time monitoring helped operators catch defects as they happened, reducing dependence on downstream quality gates.

Centralized device, camera, model, and part management reduced setup complexity and improved production traceability.

Searchable inspection history and PDF exports made reporting faster and audit preparation easier.

Live dashboards helped managers understand production quality without waiting for end-of-week summaries.

Initial Challenges

- Connecting mixed factory hardware into one setup flow required careful handling of different camera brands, protocols, image formats, and PLC communication methods.
- Keeping inspection data current without cloud latency required both real-time monitoring and background synchronization.
- Managing millions of inspection records required a dedicated search layer so teams could filter results quickly.
- Supporting both cloud and on-premise storage required flexible configuration without changing the inspection workflow.

Key Insights

1. **Quality improves when inspection happens in real time:** catching defects at the production line is far more useful than finding them later in reports.
2. **Device setup must be simple for factory teams:** guided onboarding reduces configuration mistakes and speeds up deployment.
3. **Traceability matters as much as detection:** inspection results, model versions, part numbers, users, and overrides must all be connected for compliance.
4. **Manufacturing platforms need flexible storage:** cloud and on-premise options help serve customers with different data requirements.

Conclusion

Exacto transformed manufacturing quality inspection by connecting edge devices, cameras, PLCs, ML models, and reporting into one operational system. By replacing manual spot checks with AI-powered inspection, the platform gave production teams real-time visibility into defects, performance, and quality outcomes.

Three strategic lessons emerged from the engagement:

- Build around the full production workflow, not isolated inspection tools.
- Make live visibility and historical reporting work together so teams can act now and audit later.
- Treat device configuration, model deployment, and audit logs as core quality-control features, not add-ons.