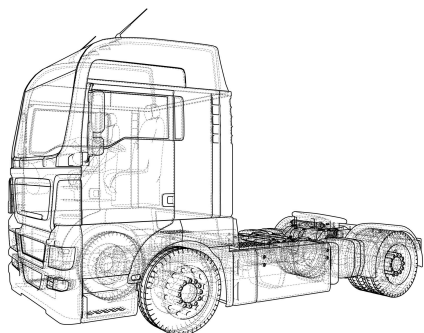


# Truck Number Recognition System (TNRS)



TNRS reads alphanumeric identifiers on prime movers using advanced deep-learning text recognition. It integrates with container yard or terminal operating systems to maintain an accurate record of which trucks handled which containers.

Unlike hardware-heavy systems like laser sensors or RFID tags, TNRS uses computer vision to detect and read truck IDs—just like a human, but faster, more consistently, and without fatigue. Think of it as a second set of eyes, AI-trained, watching each job in real time.

## HOW IT WORKS

TNRS uses AI-powered image recognition to read truck numbers in real time during container handoff:

- **Job Begins:** The crane's PLC sends job and vehicle proximity info to activate TNRS.
- **Camera Views Activated:** system monitors the truck towhead via designated primary or secondary cameras.
- **Neural Network: Stage 1 – Towhead Detected:** trained detection model identifies the front of the truck (towhead).
- **Neural Network: Stage 2 – Character Recognition:** second AI model reads vehicle number. If recognition fails, it retries with rotated frames and multiple views.
- **If Detected:** truck number is checksum validated and sent to the PLC, Yard Management System, or Terminal Operating System for logging and traceability.

The system uses multiple frames and fallback logic to reduce false positives from dirt, glare, or distorted characters.

## CAMERA INTEGRATION

TNRS is adaptable to work with **customer-specific camera layouts**. Depending on the site:

- Primary cameras are positioned to capture the towhead's number—typically from front or side angles.
- Secondary cameras may be configured for backup views or alternate recognition angles based on mover approach.
- PTZ and framing logic adjusts dynamically based on truck proximity, type, and crane job info.
- Camera selection is automated, switching between views to optimize readability and minimize occlusion or glare.



## KEY FEATURES

- **AI-powered dual-stage detection:** identifies truck numbers across fonts, positions, and color contrasts—no need for fixed placement or standardization.
- **Multi-frame validation:** uses consecutive frames to confirm accuracy and suppress false positives; includes retry logic with image rotation.
- **Real-time, adaptive monitoring:** triggers on job start and dynamically adjusts based on vehicle type and distance.
- **Intelligent camera management:** dynamically switches between available cameras (e.g., front or side views) to optimize visibility and reduce blind spots.
- **Modular and camera-agnostic design:** deploys with existing or new camera setups; supports various terminal layouts and vehicle types.
- **Confidence scoring & fault output:** provides confidence levels with each detection and raises alerts or flags via PLC.

## PERFORMANCE CONSIDERATIONS

TNRS delivers reliable performance in dynamic terminal conditions, with built-in safeguards and tuning to handle real-world variability.

- **Optimized for port environments:** trained on diverse truck ID styles, lighting conditions, and common visual obstructions.
- **Non-standard IDs:** tolerant to font differences, slight dirt buildup, and imperfect number placement.
- **Camera setup:** delivers best results when cameras are aligned and properly framed; PTZ logic helps with difficult angles.
- **Error handling:** low-confidence reads are flagged for review or retried automatically.

## DEPLOYMENT & INTEGRATION

- Connects to Terminal Operating Systems or Yard Management Systems, as well as crane automation via PLC.
- Trigger logic and monitoring flows are customizable to meet your operational needs.
- Designed for on-premise or edge computing environments with AI model deployment support.
- Each deployment uses tailored AI models trained on relevant container and twist-lock profiles. Model tuning and maintenance are part of our support offering to ensure continued accuracy across evolving port conditions.
- **Retrofit-ready:** installs alongside existing crane, gate, or yard camera systems with minimal changes to infrastructure.
- **Edge compute:** runs on local GPU-enabled vision appliances, with on-premise AI inference optimized for container yard operations.
- **PLC and system integration:** outputs are sent to crane PLCs, Terminal Operating Systems, or Yard Management Systems for tracking and job association.
- **Tunable detection logic:** trigger conditions, camera selection behavior, and confidence thresholds can be adjusted to match site-specific workflows and ID formats..

## WHAT TNRS IS NOT

- Not an RFID or transponder-based tracking system
- Not designed for automated gate control or customs processing
- Not a universal OCR engine — trained specifically on container yard truck ID formats

mVizn develops AI-powered computer vision systems that enhance safety and automation in industrial environments. Based in Singapore, we specialize in edge-deployed solutions for container terminals, ports, and logistics yards—integrating seamlessly with cranes and control systems to deliver real-time operational intelligence.

Computer vision offers a distinct advantage in dynamic, visually complex environments. By delivering object-level understanding and context-aware detection, mVizn enables operators to respond to real-world situations with greater speed, accuracy, and confidence.

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