



Machine Vision:

The Key to Driving Industrial Automation

By image recognition, it enhances production efficiency and quality through automated inspection and precise analysis

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Part II

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Machine Vision

Part II

1. Recap of Part 1

The applications of machine vision can be categorized into defect detection, guidance, dimensional measurement and identification. These applications primarily assist in improving product quality, production efficiency and optimizing manufacturing processes in the industrial domain.

By leveraging steps such as image acquisition, image processing, feature extraction, object recognition and decision-making, machine vision systems excel at tasks like surface defect detection, product tracking and verifying object shapes or designs to ensure traceability and quality control. Machine vision can guide or assist robots for precise actions and perform dimensional measurements to guarantee product consistency and accuracy.

The technological architecture of machine vision includes lighting, industrial cameras and software. Depending on the application scenario, it can incorporate components like motion control, frame grabbers and AI accelerators. An industrial PC or embedded system forms the core of the machine vision system, managing and processing operations. The system uses industrial cameras and lighting for image acquisition, with software controlling hardware for image processing, analysis and decision-making. Additional components such as motion control and AI accelerators enhance precision and efficiency in diverse applications.

2. Use Cases of Machine Vision

2.1 Defect Detection : AI-Powered Defect Detection

In modern manufacturing, quality inspection is a critical component of competitiveness. Visual inspections are prone to inefficiency and high error rates due to fatigue over extended periods. This inefficiency is particularly problematic on fast-moving production lines where manual inspections often fail to keep pace, delaying production.

The introduction of machine vision systems integrated with AI has significantly optimized defect detection on production lines. These systems:

- Acquire image data using industrial cameras, transmitted via RJ45 or USB interfaces.
- Analyze and evaluate images in real time, displaying results on screens for production staff to act upon.
- Distinguish between acceptable and defective products, routing the latter to repair stations.

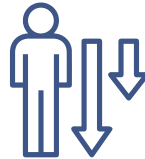
Case Study: Portwell's **PJAI-100-ON** Edge AI System



Improved
Detection
Accuracy



Real-Time
Detection



Reduced Labor
Costs



Enhanced
Efficiency



Data-Driven
Optimization

- **Improved Detection Accuracy:**

Edge AI precisely analyzes images, reducing false positives and missed defects, ultimately lowering defect rates.

- **Real-Time Detection:**

Processes images instantaneously, allowing quick identification of defects and preventing defective products from advancing.

- **Reduced Labor Costs:**

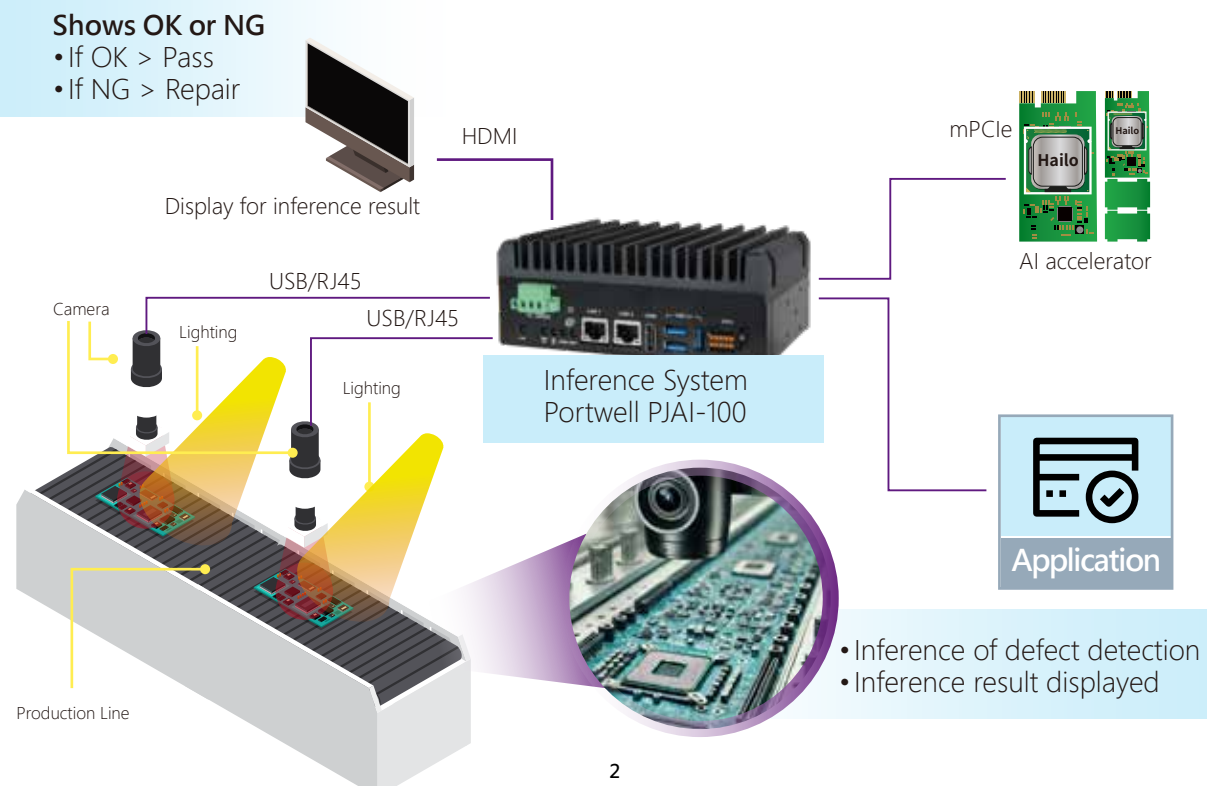
Automation minimizes human involvement in quality inspection.

- **Enhanced Efficiency:**

Maintains consistent quality control even in high-speed production environments.

- **Data-Driven Optimization:**

Records inspection data for process improvement, enabling manufacturers to identify common defects and improve quality further.



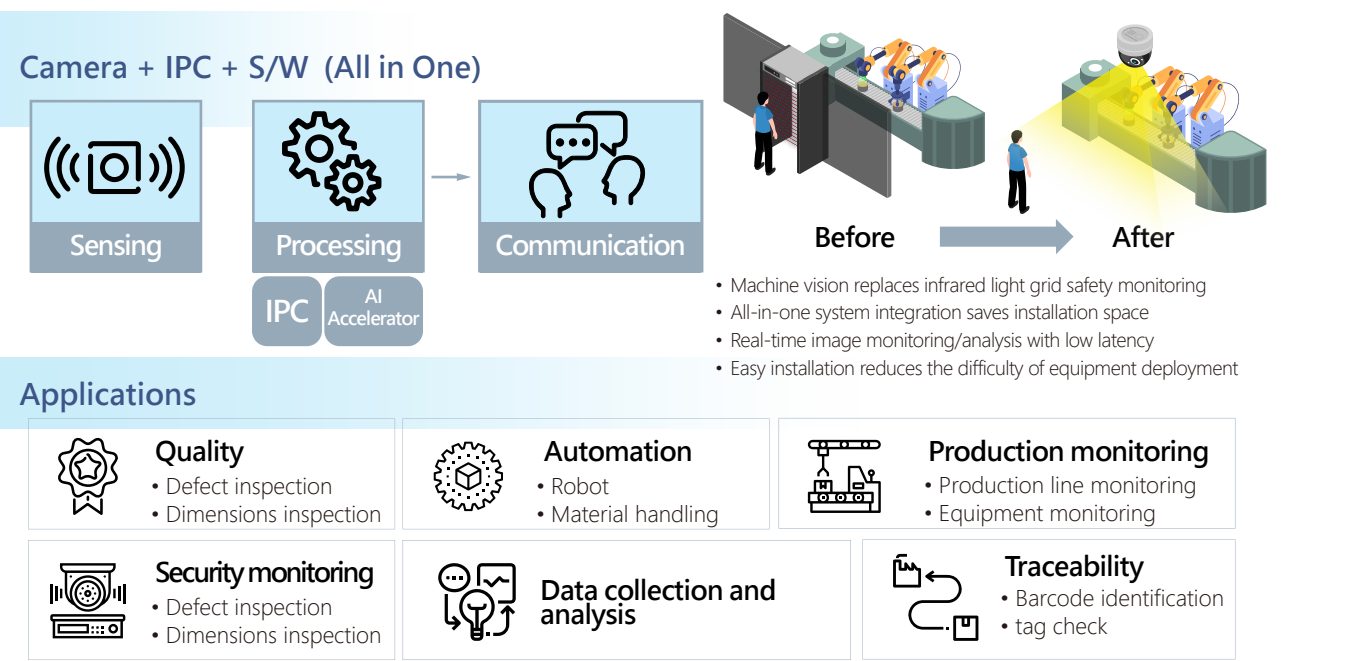
2.2 Identification : Smart Camera for Safety Monitoring

Infrared light grids are commonly used in industrial safety monitoring to detect objects or personnel entering hazardous zones. However, they provide limited information, such as merely determining proximity, without offering details like object shape, size or material.

Machine vision-based smart cameras integrate the functionalities of a camera, industrial PC and software, offering advantages over traditional systems, including:

- **Identification and Analysis:**
Recognize targets, monitor behavior and issue warnings.
- **Wider Coverage:**
Broad field of view with flexible deployment.
- **Environmental Adaptability:**
Remains functional in smoke or poor lighting conditions, with advanced imaging technology that adapts to various environments.
- **Data Recording:**
Records and stores monitoring data for post-analysis and investigation.
- **Automation Integration:**
Seamlessly interfaces with automated systems for tasks like quality control and robot guidance.
- **Cost Reduction:**
Lowers human monitoring requirements while improving operational efficiency.

Smart cameras significantly improve overall safety monitoring efficiency, thanks to their adaptability, advanced analysis capabilities and cost-effective integration.

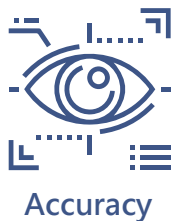
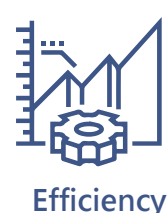


2.3 Defect Detection : Integrated with Embedded Systems

Visual inspections on production lines suffer from limitations such as fatigue and slow processing speeds, adversely affecting defect detection and production efficiency. Industrial cameras paired with embedded systems synchronize with production line speeds for defect detection. The embedded system analyzes image data acquired by the industrial camera, transmitted via RJ45 or USB interfaces. The results:

- Display on monitors for real-time decision-making by production staff.
- Upload to servers or cloud storage for traceability and record-keeping.

Case Study: Portwell's **WEBS-21J0** Embedded System



• **Accuracy:** :

Combines machine vision with WEBS-21J0 to deliver high-precision defect detection.

• **Speed:**

Matches inspection speed with production line pace for swift decisions.

• **Labor Reduction:**

Automation reduces reliance on human inspection.

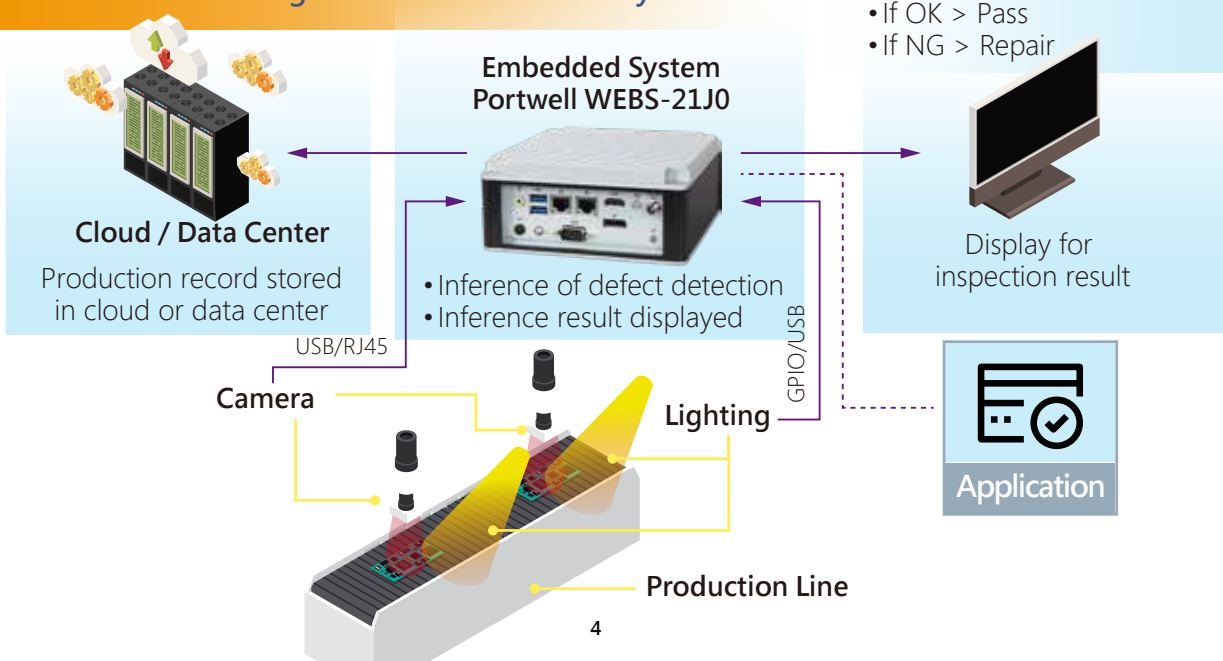
• **Efficiency:**

Ensures stable and continuous operation.

• **Continuous Improvement:**

Analyzes inspection data for process optimization and improved product quality.

Machine Vision Integrated with Embedded System



2.4 Defect Detection : Integrated in AOI Equipment

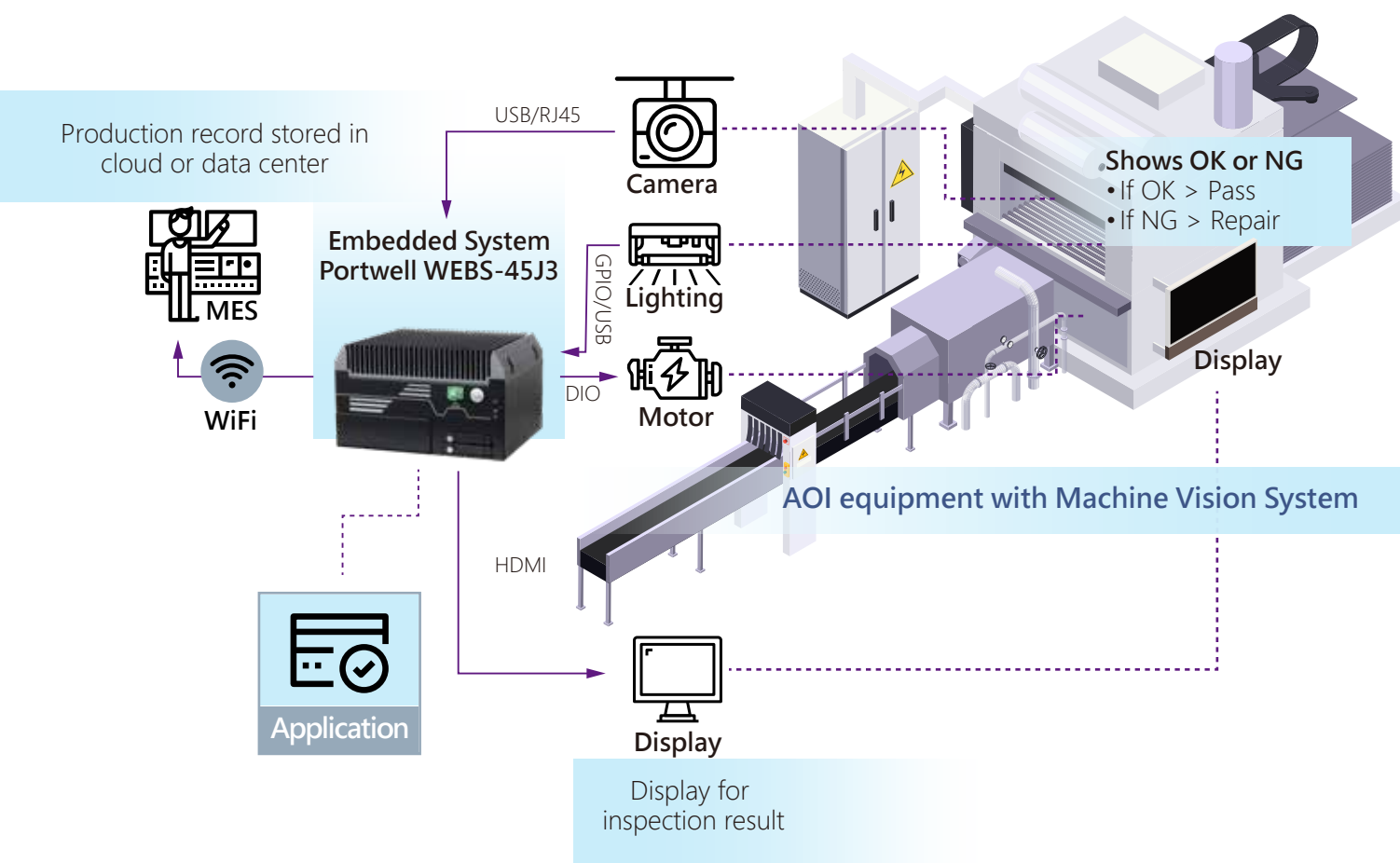
Automated Optical Inspection (AOI) equipments automate defect detection using high-resolution imaging and analysis software to ensure product compliance.

Case Study: Portwell's **WEBS-45J3** Embedded System

AOI equipment, powered by embedded systems and machine vision, form the core of advanced inspection solutions. The equipment includes:

- Industrial cameras for image acquisition.
- Lights for optimal visibility.
- Software for analysis and control.
- Embedded systems for computation and decision-making.

The integration of WEBS-45J3 with AOI equipment offers efficient, precise defect detection, supporting manufacturing industries with reliable quality assurance solutions.



3. Conclusion

The primary goal of machine vision is to enhance automation while minimizing human error. It has become an indispensable tool in manufacturing for automated inspection and quality control. Through processes like image processing, feature extraction, recognition, decision-making and output, machine vision achieves comprehensive automation. Integration with AI further expands its applications beyond manufacturing to diverse industries, fostering innovation and adaptability.

4. Portwell's Value-Added Services: **DMS, PET, RPET**

To meet diverse customer needs and machine vision system requirements, Portwell offers comprehensive services:



DMS



PET



RPET



DMS (Design and Manufacturing Services):

End-to-end solutions from design to manufacturing.



PET (Portwell Engineering Toolkit):

IoT solutions providing cross-platform APIs and applications, simplifying IoT integration.



RPET (Remote Portwell Engineering Toolkit):

Advanced remote management tools offering real-time monitoring of firmware, power, CPU usage, memory, disk status and network load. RPET ensures system stability and operational efficiency.



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