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ANTICIPATE Unlocks the Power of Machine Vision and AI to Optimize Manual Manufacturing Processes

ANTICIPATE's Digital Worker Guidance System leverages Intel® Technology to empower manufacturers to prevent errors and create efficient production lines with pre-trained and easy-to-deploy artificial intelligence models.

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ANTICIPATE is an AI manufacturing company that offers an advanced Digital Worker Guidance, empowered by AI Vision, to guide frontline workers and detect human errors in manual assembly processes. Their system addresses assembly verification, quality inspection, and production optimization, ensuring a holistic solution for manufacturing firms. The company continuously strives to integrate cutting-edge technologies into their solution to deliver state-of-the-art systems that significantly improve operational efficiency, driving the manufacturing industry forward by leveraging the power of AI and machine vision.

Bridging the Gap: Manufacturers are Seeking Digitized Solutions for Controlled and Optimized Manual Assembly Processes

Today's manufacturers face a daunting challenge. The shift from mass production to batch production is increasing the demand for manual assembly to enable flexibility.[1] Customers now prioritize being able to personalize products by choosing from various colors, sizes, and models to align with their preferences. This surge in product variances has made process automation obsolete in many industries due to the manual effort required to reconfigure and reprogram machinery for each variant. In response, the 5th industrial revolution has emerged. Companies are recognizing employees as their most valuable assets that can add value to products through customization, a skill that is difficult and expensive to replicate with automated machines.[2]

However, these manual processes are dependent on the quality of work performed by employees. This poses a challenge amidst shortages of skilled trade workers, which have adverse impacts on both productivity and quality of production. For perspective, high performers are 400% more productive than average, and this productivity gap increases with the complexity of the task.[3] The variability in these processes also increases the mental strain on employees, leading to a higher frequency of errors. Today, 72% of tasks in factories, such as assembly and packaging, are conducted manually.[4] Meanwhile, 80% of errors and 40% of equipment failures are caused by human error.[5]

In an effort to minimize errors, companies are faced with the task of training and supporting their employees in assembly activities. However, accelerated production cycle times render conventional process guidance, like scanning systems, too inefficient to keep up with customer demands and remain competitive. Meanwhile, relying solely on automated quality control at the end of the line is insufficient in detecting all errors made in manual processes and often identifies errors too late to salvage the damage. This can lead to a reactive manufacturing operation that suffers from compromised product quality and diminished profit margins.

Manufacturers have recognized the need for more holistic AI solutions that identify and prevent bottlenecks and errors in manual manufacturing processes to achieve true process optimization. Firms that have embraced vision AI are experiencing increased profit margins compared to non-adopters[2], but challenges exist with machine vision as well.

Challenges to AI Vision Implementation

Many companies want to adopt artificial intelligence to automate monitoring, streamline inefficient manual inspection, and optimize operations, but there are significant barriers to adoption. Training models for these technologies can be complicated, costly, and time-consuming. Firstly, the stakes are high, as many manufacturers have stringent accuracy requirements to ensure the safety of their products for consumers. Meanwhile, accurate models require vast data sets, data science expertise, and dedicated monitoring teams—resources that are difficult to acquire and prohibitively expensive. These factors create barriers to entry for organizations and end initiatives to optimize processes on the factory floor before they can get off the ground.

The application of AI-based image processing in manufacturing, while promising, is underutilized and slower than its potential. Particularly, manufacturers with high product variances and low production volume often encounter issues with existing AI systems due to their reliance on rigid machine learning models. These systems require extensive training data to function optimally. Even minor changes in product, components, or environment necessitate frequent model retraining, resulting in substantial maintenance efforts. Data scientists must monitor hundreds, even thousands, of these models and retrain any that underperform. This labor-intensive and expensive process underscores why AI has not fully realized its potential in the manufacturing industry.

Multiple roadblocks limit the benefits of vision intelligence to enterprises because:

Small-to-medium-sized businesses typically don't have the funds to pay for AI development teams to build and run AI solutions for their specific needs. Even a small team of AI engineers can cost as much as $320,000 annually.[3]

If a business has the budget, AI vision solutions are not usually offered with end-to-end services. Customers often need to integrate, train, and retrain models, on their own.

AI solutions are narrow in scope, designed only to address a predefined set of use cases, making it difficult for many companies to find vision AI solutions that fit their exact use case-specific needs or offer scalability in multiple areas of their business.

To address these deficiencies, ANTICIPATE leveraged Intel® technologies to create a solution that overcomes these hurdles: ANTICIPATE's Digital Worker Guidance powered by AI Vision.

ANTICIPATE's AI Vision Solution

ANTICIPATE's system helps manufacturers unlock the value of image data to improve manual processes across their workstations through a three-part approach: Seamless worker guidance, quality inspection, and process analysis. ANTICIPATE's AI Vision Solution uses a library of pre-trained models for a wide range of industrial use cases, including electronics, automotive, consumer goods, and industrial goods. These AI models are designed to provide an all-encompassing context of the numerous processes that occur on the factory floor.

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How It Works

ANTICIPATE's solution dynamically extracts information from the manufacturing execution system or ERP system to configure the inspection task for manual processes for production. By using the manufacturer's work management system for guidance, the solution facilitates easy scalability to other assembly stations and product variants without requiring the engineer to individually configure each process. This is especially critical for high-mix-low-volume manufacturers to reduce their effort in maintaining vision solutions. By eliminating the need for frequent model retraining or maintenance, ANTICIPATE's solution works more efficiently and intuitively than similar solutions on the market. ANTICIPATE's team also collaborates with customers to develop models tailored to their unique requirements.

The system can detect errors in real time, enabling immediate correction by the operator. It also collects data regarding:

- Error frequencies
- Cycle times
- Recurring errors in specific process steps
- Production bottlenecks
- Inspection images and results for quality protocol
- Video evidence for root cause analysis of inefficiencies and errors

This information is consolidated, providing the engineering or planning department with real-time monitoring, historical insights, and full process transparency to inform optimization. Traditional management of such systems would require an expensive team of data scientists dedicating countless hours to manual model monitoring. ANTICIPATE removes this complexity from the customer's hands, handling it through the solution's contextualization of the scene made possible by the combination of data from the MES or ERP system with the library of pretrained models.
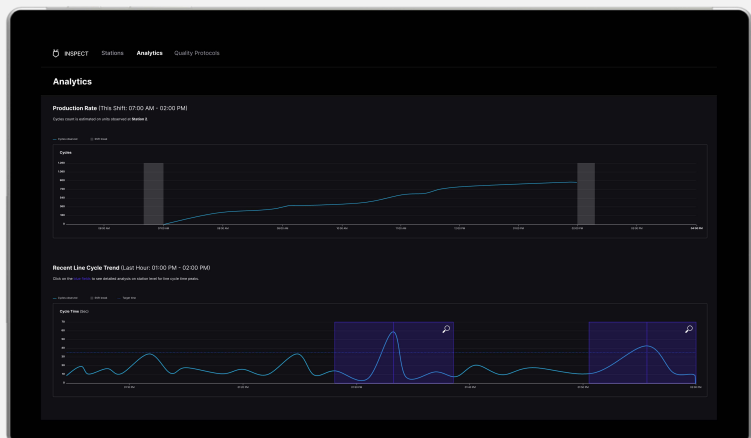
Guide your Operator
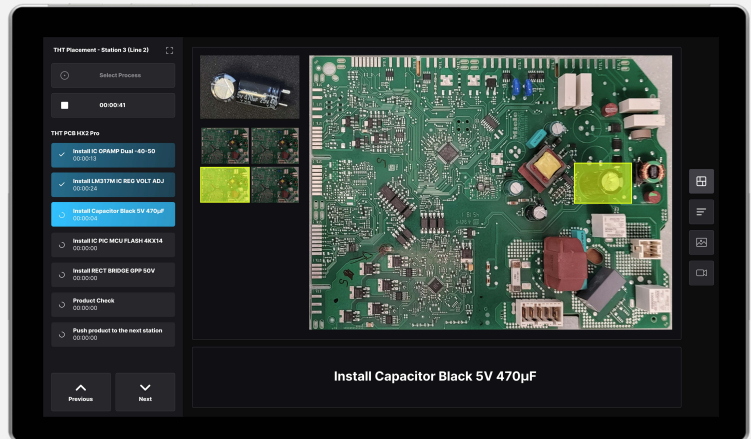
Digital Worker guidance system connected to ERP/MES/PLM to automatically enrich your work instructions with existing data

Check the results
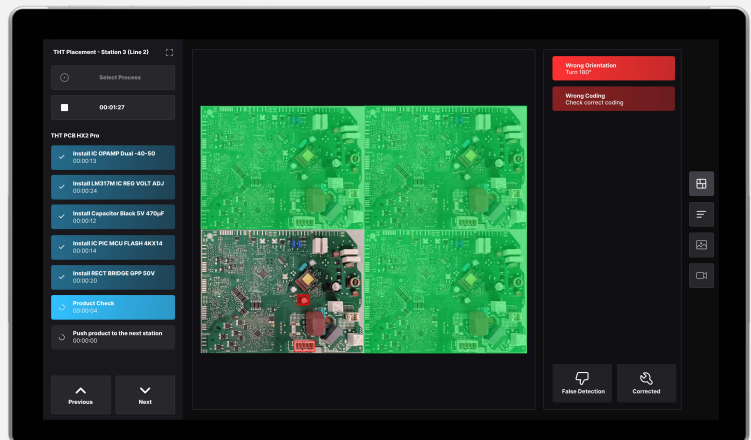
Different AI models are detecting several features of the scene and give feedback to the operator in real time if an error occurs

Analyze the process

Data about error rates, cycle times and walking routes is collected for line balancing and continuous process improvement

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Customer Benefits

Worker Guidance –
Reduce costs and save time

In the competitive landscape of production where every second and part counts, ANTICIPATE empowers manufacturers to optimize the time and value of their employees with automated digital worker guidance. Employees can reference step-by-step instructions that demonstrate the task with a full breakdown of required components and documents for processing. The ANTICIPATE solution additionally saves time by reducing activity documentation, as employees follow along the digital instructions, the platform automatically logs every completed task.

Quality Inspection –
Mitigate errors with real-time feedback

Manufacturers can dramatically reduce assembly errors by adopting ANTICIPATE's vision AI. The system transforms manual, non-digital work that's hard to track into standardized and controlled processes that eliminate subjective variations based on the operator's experience. With no code experience required, the customizable AI model library also minimizes the cognitive effort of manual tasks and can support or even replace traditional employee training methods. Through real-time tracking and instant feedback to operators, mistakes can be identified and prevented at the earliest stages of the production process. Additionally, by detecting defective parts or incorrect components, manual inspection is augmented with automation, improving the overall product quality.

Process Analysis –
Optimize manufacturing processes

ANTICIPATE's system empowers customers to optimize manufacturing processes through a combination of real-time monitoring and historical data analysis. The system's real-time vision AI detects anomalies, enabling operators to promptly implement countermeasures to address issues as they arise. Meanwhile, historical data, such as production rates and cycle times, is leveraged to identify and correct process inefficiencies. This comprehensive approach offers operators and engineers improved transparency via real-time data insights and collated historical data across the entire production process, enabling informed business decisions that help minimize inefficiencies such as bottlenecks, scrap, and machine downtime.

Key Features

Worker Guidance

- Step-by-step digital worker instructions for process support and training
- Pick-to-light capabilities
- Augmented reality instruction by laser/beamer

Quality Check

- Optical product inspection
- Verification of correct component selection
- Hand motion and process completion check

Process Analysis

- Cycle time measurement categorized by activity (e.g., uptime, downtime, line equipping) to provide insights on balancing production lines
- Walking route optimization
- Video evidence for root cause analysis of inefficiencies and errors

ANTICIPATE Leverages the Capabilities of Intel® Technology to Deliver Optimized Performance

ANTICIPATE's Digital Worker Guidance solution uses high-performing Intel® processors for versatility on the factory floor. Intel® Core™ processors deliver advanced responsiveness, connectivity, and graphics performance. Seated in fanless, ruggedized industrial gateways, these processors deliver powerful compute capabilities and can be trusted to perform in harsh manufacturing environments.

The Digital Worker Guidance solution utilizes these Intel-powered edge devices, to ingest image data from camera sensors and process data from machines and ERP systems. In addition, ANTICIPATE has utilized the Intel® Distribution of OpenVINO™ toolkit to optimize the models in their pre-trained model library for Intel® Core™ processors to ensure the best performance on these edge devices. The Intel® Distribution of OpenVINO™ toolkit enables ANTICIPATE to provide the right hardware at the right cost to meet customer requirements and get the most out of their hardware resources. The high-performance, deep

learning inference toolkit provides a full suite of development and deployment tools. The toolkit offers deep-learning models, device portability, and higher inferencing capabilities to offer minimal disruption and maximum performance and enables developers to quickly build, optimize, and scale AI-based computer vision models.

ANTICIPATE also uses the Intel® RealSense™ Depth Camera D435f to enhance its vision AI solution, particularly in environments where precise measurements and depth sensing are critical. ANTICIPATE employs the RealSense™ D435f camera during the model training phase to create 3D data and effectively label this data, generating a specialized pre-trained model that can accurately interpret hand movements. This application facilitates a more refined AI model and allows more cost-effective, traditional 2D cameras to run the pre-trained model, eliminating the need for high-tech 3D depth-sensing cameras, and thereby saving costs while maintaining high levels of accuracy in the solution.

Case Study: Optimizing a Machine Manufacturer's Pre-Assembly Process for the Controlling Unit of an Automated Guided Vehicle

Situation

A manufacturer of automated guided vehicles (AGV) discovered that the production of printed circuit boards, a component that has a direct impact on the controlling unit's performance, was susceptible to errors in its manual and repetitive process. Circuit board defects included missing components and incorrectly positioned and orientated components. Because the errors were occurring early on in production, they were resulting in significant costs and product defects. Meanwhile, implementing manual supervision of such a detailed, small-scale process would be resource-intensive and difficult to evaluate.

Solution

To address this challenge, the ANTICIPATE team developed an AI solution to support circuit board production. To simplify manual assembly of the circuit board, the solution provided:

- User-friendly digital video and text assembly instructions that automatically move forward to the next step with the operator
- Real-time inspection of the orientation and number of inserted components

- Images and activity log of completed steps for quality verification
- Cycle time recording

Results

The ANTICIPATE system successfully created a more efficient, cost-effective, and high-quality production process. Through using the circuit board guidance, assembly line workers gained the support they needed to increase first-pass yield, or the percentage of units that complete the production line without rework or repair. Manufacturers reduced customer complaints with minimal effort and maximum transparency of their production line thanks to automated documentation.

Conclusion

ANTICIPATE's Digital Worker Guidance System is a valuable tool for manufacturers across industries that offers scalable software and an extensive data library of pre-trained AI models tailored for industrial environments. The company's software and services simplify the design and implementation of vision AI systems, aiding employees in manual tasks, verifying frontline activities, and analyzing intelligence across all factory floor processes. This comprehensive approach allows manufacturers to harness the complete capabilities of machine vision for manual production processes.

To learn how you can improve your manufacturing processes with ANTICIPATE, request a Demo today!

Learn More

- ANTICIPATE Website
- ANTICIPATE Product Page
- Intel® Distribution of OpenVINO™ Toolkit Product Page

- Intel® Core™ Processors Product Page
- Intel® RealSense™ Depth Camera D435f Product Page

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