How AI and IOT are Changing Manufacturing and help to control COVID19 on the factory floor

Live webinar starts at: 9:30 – 11:00 CEST
Creating new digital leadership imperatives

Industry

- When fully integrated, new technologies could create up to **$3.7 trillion** of global GDP by 2025
- 50% of companies that embrace AI over the next five to seven years may double their cash flow
- Manufacturers are seeing an average 17–20% productivity gain from smart factories
- 75% of chemical companies plan to double level of digitization by 2020

AI

- Predictive analytics is the #1 AI use case for enterprises across manufacturing
- Machines complete 29% of tasks today and 71% by 2025
- 76% expected increase in worker production and 70% expected increase in demand for products and services based on AI
- Global access to food and water would reduce poverty for 65% of world’s rural poor
- **$60B** estimated energy cost savings for commercial buildings with 1-4% increase in intelligent technology

Workforce

- 75 million jobs displaced by automation and 133 million new jobs created between 2018-2022
- 70% expected increase in agriculture output needed to feed the world in 2050
- 400% expected increase in amount of water needed for manufacturing through 2050

Sustainability

- **$6T** annual global cost of cybersecurity damages by 2021
- **$1T** global spend on cybersecurity products and services by 2021

Cyber security

- **75 million** jobs displaced by automation and 133 million new jobs created between 2018-2022
- 70% expected increase in agriculture output needed to feed the world in 2050
- 400% expected increase in amount of water needed for manufacturing through 2050

1. 2 McKinsey – Digital Manufacturing Capturing Sustainable Impact at scale (June 2017)
3. 2016 Global Industry 4.0 Survey – Industry Key Findings; PricewaterhouseCoopers LLP
4. The Economist Intelligence Unit, Intelligent Economies: AI’s transformation of industries and society, (July 2018)
5. 6, 11 World Economic Forum, Future of Jobs report 2018 (September 2018)
7. Food and Agriculture Organization, How to Feed the World in 2050 (2011)
9. 10 DECC. Water Outlook to 2050: The DECC calls for early and strategic action. (May 2012)
10. 11 IDG Communications, Top 5 cybersecurity facts, figures and statistics for 2019 (January 2018)
And then this thing happened

COVID

100% of manufacturers have been affected and need to adapt
Navigating COVID in Manufacturing

Manufacturers are working hard to keep employees safe and support an increase in remote workers; minimize any operational disruption to keep manufacturing running smoothly for businesses and consumers; manage risk, manage cost to meet demand, and help those who need assistance the most.

**TRANSFORM YOUR WORKFORCE**
Enable remote collaboration and productivity, dramatically reducing travel costs and time spent in meetings, while also accelerating innovation needed to support Covid-19 responses.

**ENGAGE CUSTOMERS IN NEW WAYS**
Reduce customer service costs while working remotely, and transitioning to digital engagement channels, and maximize cash flow during the crisis.

**BUILD MORE AGILE FACTORIES**
Remotely assist those workers who are still needed on the manufacturing frontline, and to address cross skilling to deal with additional gaps being created by new processes needed for Covid-19.

**CREATE MORE RESILIENT SUPPLY CHAINS**
Streamline operations to meet customer demand in contact centers and deliver an exceptional customer experience with consistent, personalized support.
During a crisis that could have cost ASML millions or even billions, a cross-functional team used Remote Assist to turn a potential problem into a new opportunity to help our customers remotely.

In 3 weeks time, a consortium of companies that had never worked together before, where able to design, source, make and delivery thousands of ventilators to the NHS.

Customers have leveraged the PowerApps platform, including standard templates, Knowledge Search and Bot Framework, to create virtual agents that can communicate internally and with their clients.
### What to expect next?

#### Scenarios for the economic impact of the COVID-19 crisis

**GDP impact of COVID-19 spread, public health response, and economic policies**

<table>
<thead>
<tr>
<th>Virus spread and public health response</th>
<th>Rapid and effective control of virus spread</th>
<th>Effective response, but (regional) virus resurgence</th>
<th>Broad failure of public health interventions</th>
</tr>
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<tbody>
<tr>
<td>Effectiveness of the public health response in controlling the spread and human impact of COVID-19</td>
<td>Strong public health response succeeds in controlling spread in each country within 2-3 months</td>
<td>Public health response initially succeeds but measures are not sufficient to prevent viral resurgence so social distancing continues (regionally) for several months</td>
<td>Public health response fails to control the spread of the virus for an extended period of time (e.g., until vaccines are available)</td>
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<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Description</th>
<th>Graph</th>
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<tbody>
<tr>
<td>A1</td>
<td>Virus resurgence; slow long-term growth</td>
<td><a href="#">Muted World Recovery</a></td>
</tr>
<tr>
<td>A2</td>
<td>Virus resurgence; return to trend growth</td>
<td><a href="#">Strong World Rebound</a></td>
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<tr>
<td>B1</td>
<td>Virus contained, but sector damage; lower long-term trend growth</td>
<td><a href="#">Virus Contained</a></td>
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<tr>
<td>B2</td>
<td>Virus resurgence; slow long-term growth</td>
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<tr>
<td>B3</td>
<td>Pandemic escalation; prolonged downturn without economic recovery</td>
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<td>B4</td>
<td>Pandemic escalation; slow progression towards economic recovery</td>
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<td>B5</td>
<td>Pandemic escalation; delayed but full economic recovery</td>
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#### Ineffective interventions
- Self-reinforcing recession dynamics kick-in; widespread bankruptcies and credit defaults; potential banking crisis

#### Partially effective interventions
- Policy responses partially offset economic damage; banking crisis is avoided; recovery levels muted

#### Highly effective interventions
- Strong policy responses prevent structural damage; recovery to pre-crisis fundamentals and momentum

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**Knock-on effects and economic policy response**

Speed and strength of recovery depends on whether policy moves can mitigate self-reinforcing recessionary dynamics (e.g., corporate defaults, credit crunch)
Lessons from the past

Example based on companies that leveraged the 2008 crisis to innovate

BCG 50 Most Innovative Companies (as identified in 2007)

Morgan Stanley Capital International (MSCI) World

Reevaluate portfolio strategy and restructure

Innovate across the value chain

Evaluate org. structure; ways of working

Accelerate E2E digitization

Consider inorganic opportunities

Note: Chart compares TSR performance of publically listed MIC (Most Innovative Companies) 50 companies in 2007 (pre-financial crisis) and follows their TSR performance through the crisis until 31.12.2012. Source: Accelerating out of the great recession book; BCG Innovation Journey Analytics Database; Capital IQ

Adjust portfolio priorities to capture demand across key categories, over “Fight” and “Future” phases

Accelerate Innovation—reimagine the system to scale value-creating ideas across the value chain and customer journeys (e.g. Transform go-to-market approach)

Transform organization to enable strategic change—leverage ‘future of work’ models

Double down on shift to digital during COVID—embrace opportunities across all processes

Pursue attractive M&A options or other opportunistic moves during downturn—consider macro and company landscape
In uncertain times, responsiveness is key

DATA + INSIGHT + ACTION = VALUE
A customer’s digital use case, Pilot, or Minimum Viable Product (MVP) can start at any phase of Factory of the Future journey:

1. **Connected**
   - Enhance productivity
   - Improve quality
   - Reduce inventory

2. **Predictive**
   - Reduce conversion costs
   - Decrease lead times
   - Improve service levels

3. **Cognitive**
   - Enhance margins
   - Optimize pricing
   - Improve NPI

**Data and AI Empowering Manufacturing**
Timing is everything – access to data is critical

Before
• Analysis required, manually connecting to different & disconnected systems
• More time spent pulling & validating data, multiple sources of truth
• Complex analysis can take weeks

Now
• Data consolidated into 1 location in the cloud
• One version of the truth, a centralized taxonomy and master data connected to our ERP
• Complex analysis can be done in hours

Scalable & Accessible Data

Azure Data Lake provides Microsoft Devices with a single source of truth. Devices’ Data Lake sits in the cloud, connected to ERP workflow tools and Machine Learning applications.

During Covid our operations run demand/supply planning simulations daily.
Machine Learning on Azure

Sophisticated pretrained models
To accelerate solution development with easy to use pretrained models

Popular frameworks
Build sophisticated deep learning solutions

Productive services
Empower your development teams

Powerful infrastructure
Accelerate time to value

Cognitive Services
- Vision
- Speech
- Language
- Search

Pytorch
TensorFlow
Keras
Onnx

Azure Databricks
Azure Machine Learning
Machine Learning VMs

CPU
GPU
FPGA
AI in Manufacturing use cases

- **Product-as-a-service**
  - Connected Field Service
  - Automatic part detection
  - Smart devices
  - Guided service workflow
  - Upsell and cross sell opportunities
  - Service history insights

- **Factory of the future**
  - Predictive maintenance
  - Cognitive quality
  - Product traceability
  - Industrial robots/cobots
  - Health and safety

- **Industrial IoT**
  - Process optimization
  - Autonomous vehicles/robots
  - Machine calibration
  - Smart systems
  - Smart spaces

- **Intelligent supply chain**
  - Sourcing and procurement
  - Supply chain visibility and orchestration
  - Inventory planning and optimization
  - Integrated business planning
  - Demand forecasting
  - Integrated track and trace
  - Predictive and cognitive quality, yield
  - Warehouse automation
Despite the great technology, 60% of all initiatives stall at the PoC stage.
A Simplified View of an IoT Solution

- Things
- Insights
- Actions
Enabling the Digital Feedback Loop Can Be Challenging

Enterprise integration
Device recovery
Updating devices
Device commercialization
Device lifecycle
HW certification
Securing data
Industry and government compliance

Cloud-to-device commands
Solution scale
CI/CD
Disaster recovery
On device analytics

Data storage
Cold path analytics
Hot path analytics
Cold path analytics
Hot path analytics

Fault tolerance
Business process integration
Operations monitoring
Cost management
High availability
Provisioning devices
Warm path analytics
Data ownership
Transport protocols

Data visualization
Drivers

<---End-to-End Security--->

Insights

Things

Actions

Manufacturing scale
Device updates

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In uncertain times, responsiveness is key

DATA + INSIGHT + ACTION = VALUE

IoT & Edge
Advanced Analytics
AI & Cognitive
Graph Technology
Blockchain
Digital Workplace
Mixed Reality
3D Printing
From Data Science to Data Production
MLOps = ML + DEV + OPS

**Experiment**
- Data retrieval
- Business understanding
- Initial modeling

**Develop**
- Testing
- Continuous Integration
- Continuous Deployment

**Operate**
- Continuous Delivery
- Data Feedback Loop
- System + Model Monitoring
ML DevOps Process – Schneider (Realift)

“Automate the E2E model lifecycle.”

- **App Developer**
  - IDE
  - Consume Model
  - Customize Model
  - Update Application

- **Data Scientist**
  - Train Model – Azure ML
  - Publish Model
  - Retrain Model

- **Azure ML Model Registry**

- **Azure DevOps**
  - Validate & Deploy Application

- **Edge Devices**
  - Collect Feedback

- **Model Telemetry**
  - Predictive maintenance model
Social Distancing and Safety

Use cases

- Identification of Personal Protection Equipment (including masks)
- Proximity alert
- Crowd detection in restricted areas
- Man down identification

Technology

- Cognitive Services on top of Camera / Surveillance systems
- Smart Safety Tags

Partners

- ROBOVISION
- BOSCH
- GUARDHAT
- 4WARD
Supply Chain Visibility Dashboards

- Being well informed in these times of constant changes is critical for Supply Chain operations. Reducing the time it takes to present insights that can help in making informed decisions is key. Whereas it was OK before to spend hours (or even days) to collect data in spreadsheets and power-points before meetings, these insights need to be available immediately in order to become more responsive to the changes.

- Based on the concepts of the Crisis Communication Apps, one of our customers has refocused this from internal communications only, towards providing essential information in real-time to support their supply chain operations. In 2 weeks' time they have developed an extensive visibility and drill-through dashboard that will be used in the daily alignment calls between their demand managers and plants.
Next steps

1. **RESPOND**
   - Navigating the Now
   - Rapid Response to immediate challenges to continue operations

2. **REBOUND**
   - Planning the Comeback
   - Rebound from shutdowns and restart operations to scale quickly

3. **REIMAGINE**
   - Shaping the New Normal
   - Reimagine your business, setting a new ‘North Star’ for resilient operations in the new normal

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**Business Outcome Workshop**
Engage with Microsoft Services in a 1:1 workshop to scope innovative solutions, architectural design, and next steps

**Deeper Solution Design Session**
Explore any of our solution areas in a more detailed session

**Proof of Concept**
Begin a POC with support of key engineering teams and partners
More Information

Microsoft Manufacturing Community  aka.ms/manufacturing

Patrick van Loon  patrick.vanloon@microsoft.com

1. REPSOND  Navigating the Now
   - Rapid Response to immediate challenges to continue operations

2. REBOUND  Planning the Comeback
   - Rebound from shutdowns and restart operations to scale quickly

3. REIMAGINE  Shaping the New Normal
   - Reimagine your business, setting a new ‘North Star’ for resilient operations in the new normal
The challenge of COVID19 for Manufacturers

- Initial Response
- Back to Work
- Back to Normal
- Immunity Roll-out

You are here

Start

Back to Work Plan

Virus as Normal

Immunity Roll-out

Finish
Why Manufacturers need COVID Control

Without Contact Tracing a manufacturer risks multiple unplanned outages, an at-risk workforce

1 unidentified case + Unidentified location

- A Closed Factory
- An Isolated & at Risk Workforce
- Lost Revenue
- Unmanaged HR Costs
Why a manufacturer needs COVID operations

Get Back to Work and Stay Safe – plan locations to support separation

Close a Machine

1 unidentified case

Close a Section

1 at Risk Team

Close a Line

1 at Risk Shift

Close a Building

1 at risk Factory
Why Manufacturers need COVID Control

With Contact Tracing and active COVID HR support risks are isolated faster, the scope of the impact is reduced, and HR, testing and other costs are minimized.
Capgemini’s back to work, stay at work plan for manufacturers
Protect your workers and clients with tech for social distancing and contact tracing

People

- Factory Floor and facilities Social Distancing monitoring
- DP-3T work badges & location tags
- Contact Tracing Console

Process

- COVID19 processes planning
- Proactive Staff Isolation
- Testing Management
- Disinfecting and location management

Technology

- Social distancing analytics
- AI-driven COVID19 exposure risk assessment
- Immediate incident management
- Economic impact assessment
- Enterprise & local authorities policies alignment

Dedicated COVID Process Support & Call Center

Enterprise Command Center

Social Distancing Monitoring and Contact Tracing Rollout with location risk support

Facilities, staff and field contact tracing

- Factory Floor and facilities Social Distancing monitoring
- DP-3T work badges & location tags
- Contact Tracing Console
Making Locations Workers Aware
Blue Tooth BLE Nodes Installed on different parts of the factory

People Aware Locations

Worker A and B cross paths
Worker A Mobile Worker B Mobile

Worker A works at mnfct line
Worker A Mobile Mnfct Line Tag

Worker C works at mnfct line
Mnfct Line Tag Worker C Mobile

Worker A tests positive for COVID-19
Worker A Mobile Mnfct Line Tag
Worker B Mobile Worker C Mobile

Business and people informed
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The Safety Badge provides a simple, robust, wearable proximity sensor, proven in industrial settings.

- **Device Characteristics**
  - BLE and LoRa communication

- **Functions**
  - Real-time (scan every 400ms) proximity alerts and recording using BLE advertise/scan protocols.
  - Supports indoor Geolocation using BLE Beacons if required, to trace zone presence.
The transformation of manufacturing by AI has already started

- 52% of the European manufacturers are implementing AI solutions
- 47% of French manufacturers are implementing at least one AI use case in manufacturing (Germany: 69%)
- 30% reduction in lost sales achieved by Danone by using machine learning to predict demand
Main elements to focus on

Key criteria for choosing where to focus first

1. Relative ease, cost and delay of implementation
2. Clear business value and quantifiable benefits (KPIs)
3. Availability of resources: data, expertise, infrastructures
4. Capacity to add explanations and visibility to ease adoption

Use cases to focus on

PREDICTIVE MAINTENANCE
Technique to predict the future failure point of a machine component, so that the component can be replaced, based on a plan, just before it fail.

QUALITY CONTROL
System of maintaining standards in manufactured products by testing a sample of the output against the specification.

DEMAND PLANNING
Process of forecasting the demand for a product or service so it can be produced and delivered more efficiently and to the satisfaction of customers.
Capgemini Accelerators to improve Manufacturing Operations and reduce COVID19 Risks

**Demand Forecasting & Inventory Planning**

**Digital Control Room / OEE**

**Predictive Maintenance**

**Worker Safety & COVID19**

**Supplier performance evaluation**

**Quality-as-a-Service / Visual Inspection**

**Asset Performance Management**

**Energy Saving as A Service**

- Training Time ~ 5 pt
- Maintenance Cost
- Yield ~ 1.3 pt
- Spend Visibility

**Benefits**

- Productivity ~5.7%
- Energy ~ 6.5%
- OEE
- MTBF

**Benchmark**

- Yield ~ 1.3 pt

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Capgemini Intelligent Operations Platform for Manufacturing

Data & AI Platform
A central platform for data management and AI use case development

Strategic Alliances & Partners

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Capgemini Intelligent Operations Platform for Manufacturing: Microsoft Azure

**Intelligent Operations Platform**

- **Data Centricity Foundation**
- **AI & Analytics Foundation**
- **Platform Foundation**

**Activation**

**AI & Analytics Execution**

**AI & Analytics Foundation**

**Data Centricity Foundation**

**Data Trust**

**Platform Foundation**

**Existing Systems & Analytics Applications**

- **Plant Design & Simulation**
- **Asset Management**
- **Digital Worker**
- **Ops Intelligence**
- **Advanced Planning**

**Artificial Intelligence Applications**

- **Predictive Maintenance**
- **Quality Inspection**
- **Control Tower**
- **APM Scheduling**
- **Worker Safety**

**Data Exploration & Predictions**

- **Data Cleansing, Integration & Enrichment**
- **Batch & Real-Time Data Ingestion & Orchestration**

**Modelled Data Store**

- **Industrials Control Systems / SCADA / PLC**
- **IIoT / Robotics / Edge**
- **MES**
- **Shop Floor Intelligence**

**Enterprise Apps**

- PLM
- ERP
- Asset Mgmt. (e.g. Maximo)
- Finance, HR

**Engineering**

- Plans/designs
- 3D Models
- Simulations

**Factory Operations**

- Industrial Control Systems / SCADA / PLC
- IIoT / Robotics / Edge
- MES
- Shop Floor Intelligence

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Real Life Customer Stories
AI potential across the breadth and depth of manufacturing operations

**Demand planning**
AI enables organizations to optimize product availability by leveraging out-of-stock and pipeline data. It can also help organizations gain a better understanding of sales patterns.

Intel uses AI algorithms to predict demand based on a wide variety of data gathered from social media, weather, and financial markets.

**Inventory Management**
AI can be used to get a better understanding of inventory levels and enable organizations to plan ahead and avoid stockouts.

**Production**
AI can be used to optimize production processes, improving efficiency.

Mitsubishi Electric uses AI to automate assembly, speed, coordination, etc., of the industrial robot leading to a 20% reduction in setup and 1/10th of conventional methods.

**Process control**
AI helps organizations optimize processes to achieve production levels with increased consistency, economy, and safety.

Unilever uses AI to influence operations by predicting outcomes and improving efficiency levels to optimize output.

**Quality control**
Product quality inspections using uniformity and efficiency in quality control, using image-based and sensor-based processes.

Bridgestone uses AI to promote high-level of processes in tire manufacturing, resulting in an improvement of more than 13% over traditional methods.

**Maintenance**
AI can help organizations predict and prepare for future failures, reducing overall downtime.

General Motors uses computer vision to analyze images from robot-mounted cameras to spot early signs of failing robot parts.

**Safety**
AI is used to get a better understanding of risk factors within the shop floor and can help plan safer operations.

**Energy management**
AI helps organizations gain deeper insights into the energy use throughout the production process, resulting in reduced bills and more sustainable production.
3 use cases from Car Body Shop

**Equipment Failure Prediction**

Equipment includes Welding Robots, Tip Dresser, Servo Motors, etc.

**Flexible Cable Burn Out Prediction**

Data includes welding process data, welding set up data, fault & failure history

**Glue Leakage Prediction**

Leakage includes filling & application head of greasing robots & dosers.
Predictive Maintenance of Machines/Robots

Context

Client: German automotive leader
Goal: Develop industry 4.0 platform
Why? Optimize machines & equipment availability in factory:
➢ Reduce machine down time
➢ Reduce machine breakdowns
➢ Reduce disruptions

Solutions

• Analyze 500+GB of data
• Developed & validated failure prediction models
• Physical failure testing is closer to model outcome
• Platform implemented for a plant with 600+ robots

Benefits

• Saved 500 minutes/weeks of operational down time for about 600+ robots
• Move from preventive to predictive with advanced analysis
  - Trends in machine or equipment malfunctions
  - Manufacturing process performance & quality
Predictive Maintenance of Machines/Robots
A reliable transport through the production line is ensured by our Predictive Maintenance solution.

Questions by the customer

Can we improve the production process by learning from failure cases that are caused by parameter combinations?

All parameters at all stations are within range. However, we see failures in the product.
A reliable transport through the production line is ensured by our Predictive Maintenance solution.
A reliable transport through the production line is ensured by our Predictive Maintenance solution

**Background**

- Currently breakdowns of the production transportation system caused by the electric engines are responsible for damages reaching six-figure sums

**Solution**

- Deployment of a predictive maintenance real-time monitoring of the transportation system

**Benefits**

- Improve performance of production line by rising uptime and reducing maintenance costs
- Creation of a scalable solution which is expandable in other factories and use case scenarios
AI potential across the breadth and depth of manufacturing operations

Demand planning
AI enables organizations to optimize product availability by decreasing out of stocks and markdowns. It also helps with getting a better understanding of sales patterns. L’Oréal uses AI algorithms to predict demand based on a wide variety of data gathered from social media, weather, and financial markets.

Inventory Management
AI can be used to get a better understanding of inventory levels, enabling organizations to plan ahead and avoid stockouts.

Production
ai can be reduced by using AI to streamline manufacturing processes, improving throughput. Mitsubishi Electric uses AI to automatically adjust valve, speed, and temperature, etc., of the industrial robot leading to a time reduction of 1/3 of conventional methods.

Process control
AI can help organizations optimize processes to achieve production levels with increased efficiency, economy, and safety. Unilever uses AI to influence operations by predicting customer and improving efficiency/levels to optimize output.

Quality control
Product quality inspections bring uniformity and efficiency in quality control, using image-based and sensor-based processes. Bridgestone uses AI to promote high levels of precision in tire manufacturing, resulting in an improvement of more than 10% over traditional methods.

Maintenance
Using AI, organizations can predict and prepare for asset failure, reducing service-related downtime. General Motors uses computer vision to analyze images from robot-mounted cameras to spot early signs of failing robot parts.

Safety
AI is used to get a better understanding of risk factors within the shop floor and can help safer operations.

Energy management
AI allows organizations to gain deeper insights into the energy use throughout the production process, resulting in reduced bills and more sustainable production.
Visual quality AI that is verifying vehicle engines are assembled correctly

**Client:** Car manufacturer  

**Goal:** Detect quality issues on the assembly line and not at the end  

**Why?**
- Final assembly is mainly an area of manual task execution: increase the likelihood of assembly errors  
- Problems are usually detected at the final quality control loop and lead to delays and rework effort.

**Context**

**Solutions**

- Creation of a *shop floor application* that detects errors using machine learning algorithms  
- **Standard industrial cameras** are used to capture images.  
- **Evaluation** of the images uses *open source component* on the shop floor without a server or cloud connection needed  
- **Results** are transferred to the shop floor using a custom built OPC-UA adapter

**Benefits**

- The initial viability study was completed after two weeks only  
- Using open source applications only our customer is free of the usual vendor lock-in of shop floor hardware solutions.  
- Since the go live **no defects** have slipped through the visual quality check.  
- The initial solutions can be adapted to other scenarios and plants.
Reach out to schedule a videoconference call for “Reopen and stay Open” or “AI Readiness” assessment!

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