InovecTech

Digital manufacturing transformation for all

InovecTech

Human-machine collaboration that solves the toughest problems

www.inovec.tech

The global pioneer of dynamic virtual sensors InovecTech is disrupting industrial digitalization

InovecTech had developed and tested cutting edge human-in-the-loop AI achieving:

99.99% reliability of an individual virtual sensor installed in **10** seconds

1 day required to digitalize a manufacturing SME, compared to conventional 6-12 months

>100 thousand sensors installed in production and warehouses

The future is not automatic. Man-machine collaboration is the future. We know it.

InovecTech team bridges manufacturing digitalization with cutting edge AI to deliver a revolutionary data solution

Expertise

- Pioneer of Virtual sensing factories (VSF) = human-in-the-loop AI for the toughest problems
- Advanced computer vision methods (CNN segmentation, tracking etc.)
- Digital transformation of production, IT systems and data for production
- Optimization and simulations
- Edge computing and hybrid cloud-edge infrastructure

Team and values

- >60 experts, high level of flexibility based in CZ, SK, PL and VN
- Top talent access in CZ/SK
- Innovation: leader of technology transfer, cooperation with a number of academic staff and companies
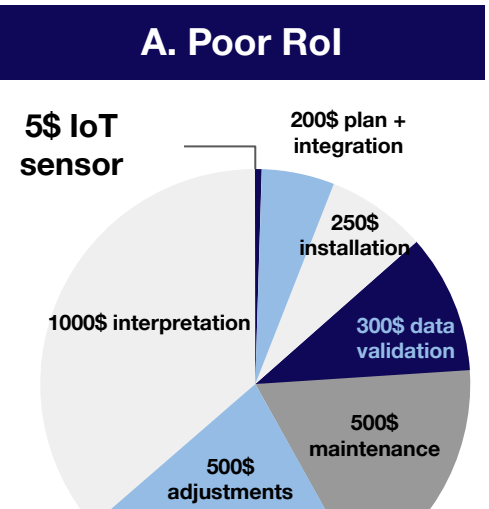
Growth and support

- Awards and support from MSIC, TAČR, CzechInvest, EIT, EIC seal of excellence, Czech AI awards finalist
- Growing network of implementation partners
- Leading digital twin solution for metallurgy warehousing

Digitalization of shop floor through traditional physical sensors is a dead end!

Why the promised fourth industrial revolution hasn't happened yet

Published: February 27, 2023 6.15pm CET

Manufacturing is lagging behind white collar industries due to real world data acquisition cost, time, convenience, reliability, and analytics issues

A. Poor RoI

5$ IoT sensor

200$ plan + integration

250$ installation

300$ data validation

1000$ interpretation

500$ maintenance

500$ adjustments

B. Long time to install

Domain expert must align with sensor and data specialists & management

C. Catch 22

To install sensors, you need a business case, for which you need analysis, for which you need sensors

D. AI cannot extract insights from heterogeneous sensors
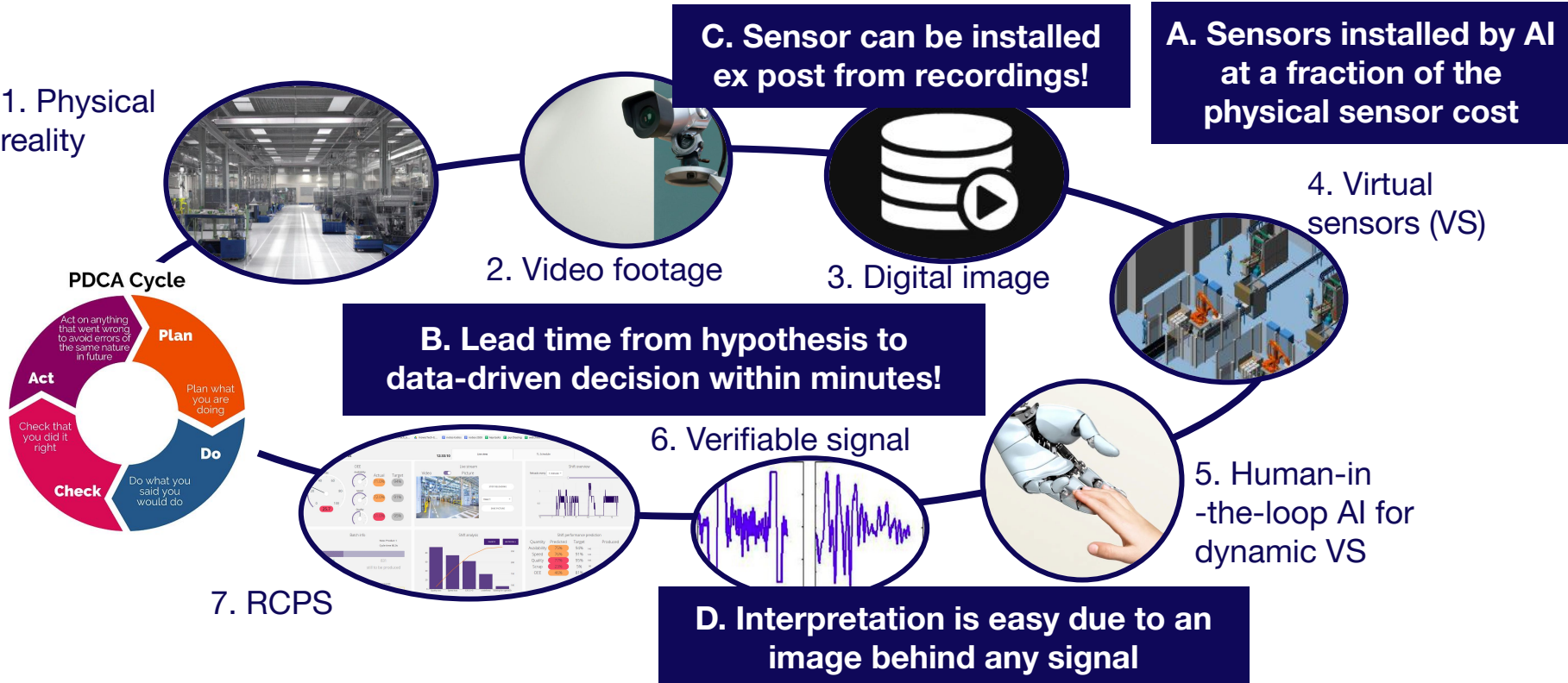

2015

2016

2024

SELF-DRIVING CARS IN 2 YEARS

RADIOLOGISTS OBSOLOLETE IN 5 YEARS

RADIOLOGISTS IN REGULAR CARS DRIVING TO WORK

CausalPython.io

Virtual sensors (AI agents) can be installed on a digital image quickly, on demand, and ex post

C. Sensor can be installed ex post from recordings!

A. Sensors installed by AI at a fraction of the physical sensor cost

1. Physical reality

4. Virtual sensors (VS)

2. Video footage

3. Digital image

PDCA Cycle

Act on anything that went wrong to avoid errors of the same nature in future

Plan

Plan what you are doing

Act

Do

Check that you did it right

Do what you said you would do

Check

B. Lead time from hypothesis to data-driven decision within minutes!

6. Verifiable signal

5. Human-in-the-loop AI for dynamic VS

7. RCPS

D. Interpretation is easy due to an image behind any signal

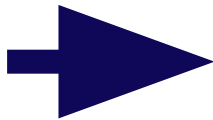# Dynamic virtual sensors ensure high accuracy and flexibility at low cost thanks to man-machine collab
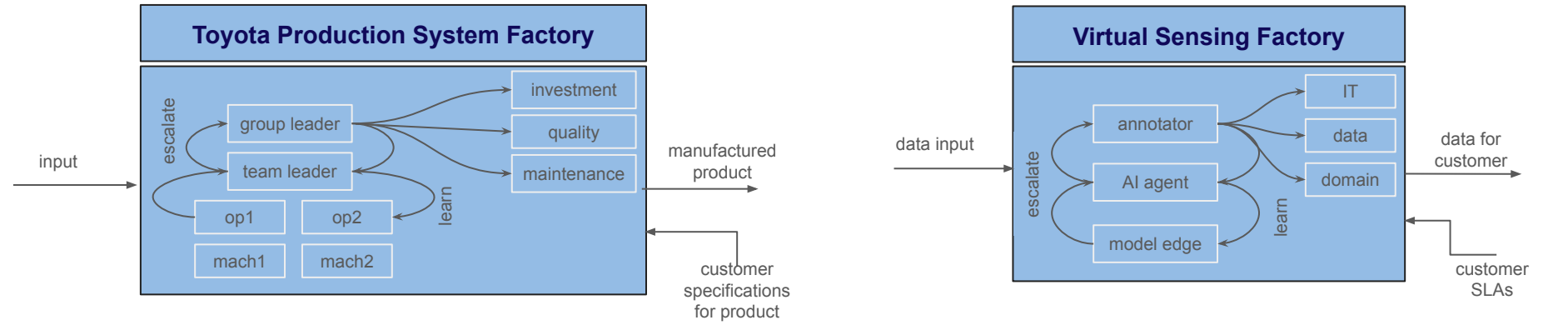
MACHINE:
Accuracy, Speed
Resilience
Consistency
Low costs
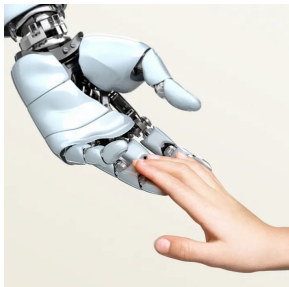
HUMAN:
Flexibility
Common sense
Experience

Practically 100% success in toughest real world digitization projects

We advance digital transformation of large corporates (Skoda, US Steel) through easily integrable modules

A1 AI platform

Problem: using AI models for shop floor insights is tedious and expensive due to overheads and management - project preparation, supplier sourcing etc.

Solution: an on-premise platform where all users can request a model and AI suppliers can bid on standard request form (within seconds!), so the client chooses the best solution = fastest, most reliable, cheapest

Impact: reduction of variable cost of AI development and deployment by 50-80%, acceleration of AI adoption by 10-100X

A2 Virtual sensors

Problem: physical sensors for shop floor digitalization require domain experts to work with sensor and data specialists over weeks to refine and validate the data, TCO over 5 years is typically 5k EUR

Solution: static virtual sensors (classical CNN models) can be deployed seamlessly within minutes and the data can be obtained for the past from recordings. Dynamic virtual sensors enable constant control over reliability

Impact: 80-90% TCO reduction for shop floor digitalization, 90-95% time reduction

A3 Analytical solutions

Problem: factories drown in data, develop and maintain expensive custom IT and data solutions, that are inflexible and difficult to integrate

Solution: a flexible toolbox of our or third party solutions including MES, WMS, APS, CMMS, ERP, PLM, QMS and BI tools that range from "instructive" connected spreadsheets to robust on premise or cloud services

Impact: 20-70% reduced time to deliver tech components for digital transformation, 20-50% reduced adoption time

We rapidly deliver shop floor digitalization to manufacturing SMEs

B1 Ops diagnostics

Problem: manufacturer or their partner need to know the state of their operations, improvement opportunities, their impact, costs, risks

Solution: 1 week AI-enabled "x-ray" data collection and interviews

Impact: rapid assessment of shop floor with suggestions to improve performance by 5-20%, high

B2 Shop floor digitalization

Problem: manufacturer need to collect continuously data from the shop floor to improve performance management, assess investments, track transformation progress etc

Solution: edge devices installed long term close to the machines

Impact: 5-30% OEE improvement, best practice performance management, reduction of root cause problem solving times by 30-80%, improved collaboration among staff

B3 Digital twin modules

Problem: manufacturer wants to improve performance of their internal logistics, warehousing or production usints through piloting digital twins

Solution: plug & play factory digital twin module

Impact: high management transparency, up to 100% track & trace capability, 20-40% reduction on workload fluctuation

We digitize factories, saving 95+% of the time and 80+% of the costs, installed >100k virtual sensors in 4 years

SME tier 2 auto supplier digitized its stamping shop operations in a 2-day visit

Situation	Approach	Results
• The new plant uses a variety of aged automatic and manual presses each with its own system • A need to monitor production for improvement (SCT ~1-5s) • Limited IT staff (1 FTE per 50ME revenue, mainly cybersec)	• Week 0: 1h VC for problem definition and installation planning • Week 1: 2-day plant visit, first day 2h trial, setting up access with IT, second day cabling and system testing • Week 2: selection of terminals for operators (smartphone)	• Video recordings of all machines, view inside the molds • SW sensors for monitoring cycle times, OEE • Further custom analyses using export to Google Sheets.

Prehliadanie videi

Please select date and camera from the menu and press 'LOAD' for loading videos.

Write what is wrong...   SEND PROBLEM REPORT

2024-03-12

5H ←   1H ←   15M ←   5M ←   1M ←

Custom machinery producer digitized the entire pre-assembly shop floor after a 1 day visit
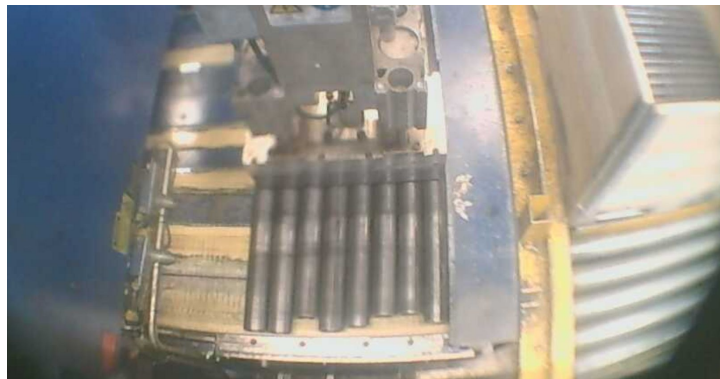
Situation	Approach	Results
• Complex machinery production • New NC machines introduced in the plant • Strong digitization push	• 16 machines digitized using 10 InoVis edge devices • Collection of data from operators through another IT partner	• Granular control of production effectiveness • Improved production planning and scheduling

E	F	G	H	I	J	K	L	M	N	O	P
CTX400-44133	LYNX220LMS-45332	PUMAGT2100-44132	LYNX220L-44131	LYNX2100LSY-45333	LYNX220LSYA-45331	VC630AX-48851	DMC835V-52321	IKC860FB-52252	DMC1035V-52322	CTX510-44171	NEF400V1-44121
5	0	121	78	0	49	1	239	0	0	0	117
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	2	0	11	0	0	0	1
1	3	33	60	17	35	2	176	16	13	0	134
0	0	0	0	0	0	0	0	0	0	0	1
0	0	3	0	0	1	0	15	0	0	0	3
2	25	37	44	9	27	8	209	14	0	0	82

# Tier 2 auto supplier installed InOEE MES and integrated to its ERP and from there to PLM and CRM

Situation	Approach	Results
• A wide range of specialized expensive machines • ERP provider wanted to expand towards MES, but lacks skills for shop floor analytics and machine connection	• Installation of 10 InoVis devices to observe all 10 relevant machines and 1 server for dashboards • Longer time to integrate with ERP (IT provider needed push)	• MES installed and integrated • Better understanding of product costs

Rolling stock manufacturer sped up ramp-up of the newly installed production unit

Situation	Approach	Impact
• New investment in a ~3ME production unit in Czech plant, ramp-up too slow • Complex unit requires refinement of tech & process	• 6 months installation with shared viewing dashboard and end presentation	• Proof of concept for rapid and flexible digitization • Prioritization of tasks • Pooling to improve OEE by ~2%
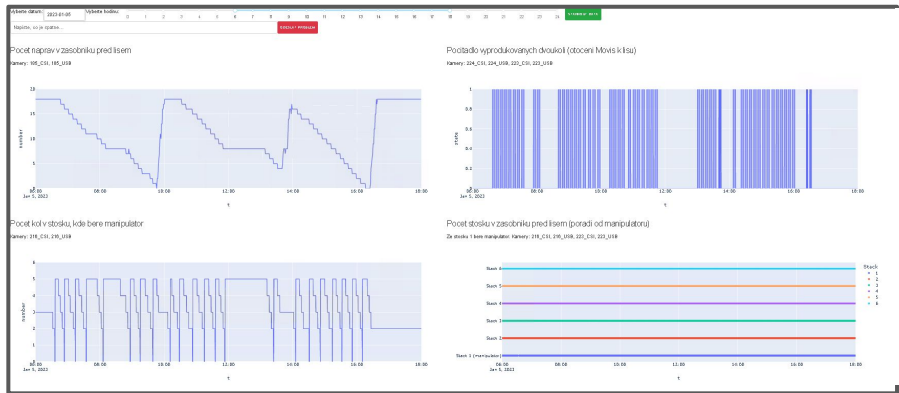
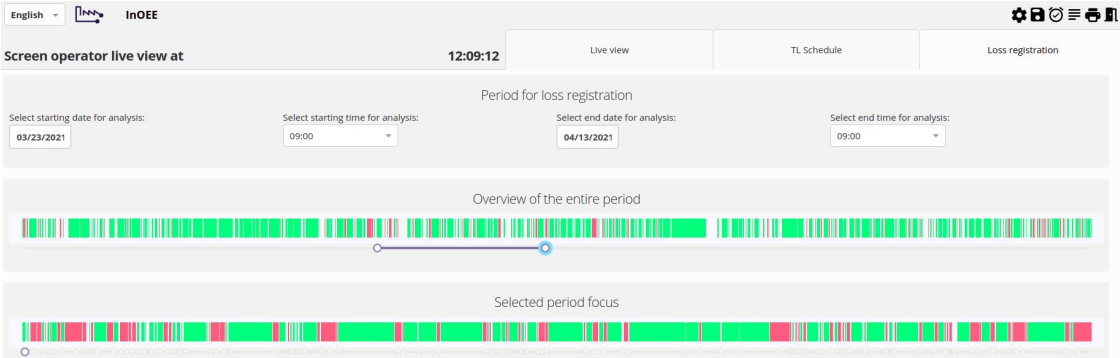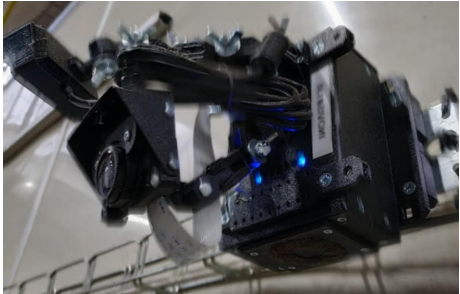Náběh TEEP a OEE po měsících

— TEEP — OEE

Rolling stock manufacturer observes material flow through shop floor and OEE of key machines

Situation	Approach	Impact
• Complex production spread across a 8th m2 hall • Partially manual production, but with specific positions of well visible material • Wide range of products, but cycle times in 2 groups	• Project approach - planned months in advance, prepared data requests • Installation of 16 InoVis devices and shared ~30% of 4 servers used for other projects • People not observed, but movements of the material across hall also tracked	• Real-time viewing dashboard for performance, counts, sensor data • Observation of trucks, painting, automated cleaning, lacquering etc. • No integration with other systems needed

Precision goods manufacturer could increase production by 5% after 24h installation of InOEE
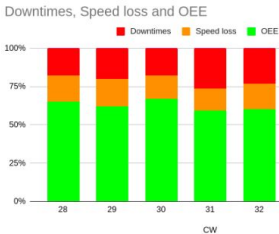
Problem	Solution	Impact
• High complexity manufacturing with increased demand • OEE tracked using bottom-up summing of downtimes, speed loss omitted by the process engineers	• 24 hour observation of the bottleneck machine • Measurement of microstops and 1h root cause problem solving using our dashboard with collected visual data	5% production increase

Construction manufacturer digitized shop floor in 1 working day

Situation	Approach	Impact
• Polish plant manufacturing 200k windows per year on ~15 production units • Each unit has different dimensions	• Remote discussion with the management • Installation of InOEE during the weekend	• InOEE diagnostics showed opportunities and recommendations • Production team continues diagnostics and implements

Prescription glass manufacturer improved operations after following recommendations from our diagnostics

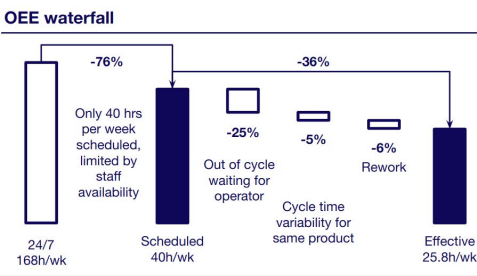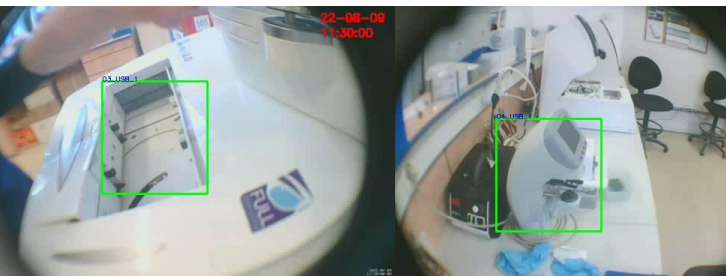| Situation	Approach	Results
• Traditional prescription glasses manufacturer with specialty len cutting equipment faces productivity decline • 5-10 shifts a week on machines depending on the demand	• 1 day to install 4 edge devices to observe 4 key machines • 84 hours of machine operation footage in 1 working week, >500 frame manufacturing cycles analyzed • VSM, AVA, OEE analyses	• Identified opportunities in planning, layout and work pooling and further data collection for performance mgmt • ~20% productivity increase within 6 months since the diagnostics

OEE waterfall

-76%   -36%

Only 40 hrs per week scheduled, limited by staff availability

-25% Out of cycle waiting for operator

-5% Cycle time variability for same product

-6% Rework

24/7 168h/wk

Scheduled 40h/wk

Effective 25.8h/wk

Improvements

Prioritising material replacement for operator

Pooling machines & operators

Data collection and tracing to reduce rework

More detailed SOPs
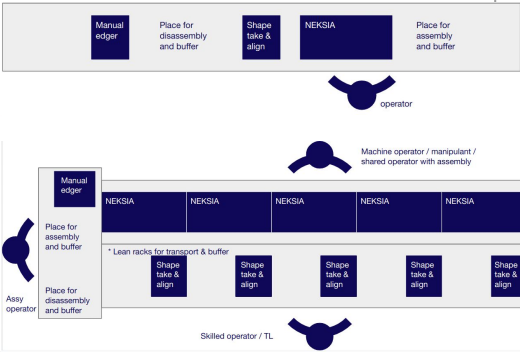
Chaotic warehouse digitisation in a steel mill

Problem	Solution	Impact
- Product in the warehouse is difficult to find - RFIDs do not work - Manual search required ~ 6h/day per warehouse	25 edge devices installed in one warehouse - tracking inventory via CV/AI - real-time visualisation	- improved material flow stability - FTE saving - transparency on inventory & material flow

Product tracking

Product view, digital twin

Dashboard w/ real-time database

Steel manufacturer manages the main shipping warehouse using digital twin fueled by our SW sensors

Situation

- Legacy warehouse overloaded due to high production
- Warehouse absorbing variability from production and customers

Approach

- 120 robust edge devices (100 stationary, 20 on cranes) with 300 cameras
- 100,000 SW sensors to detect material and vehicles

Impact

- Proof of concept for rapid and flexible digitization
- 120k EUR p.a. expected direct savings + ~200k EUR p.a. indirect savings currently being confirmed
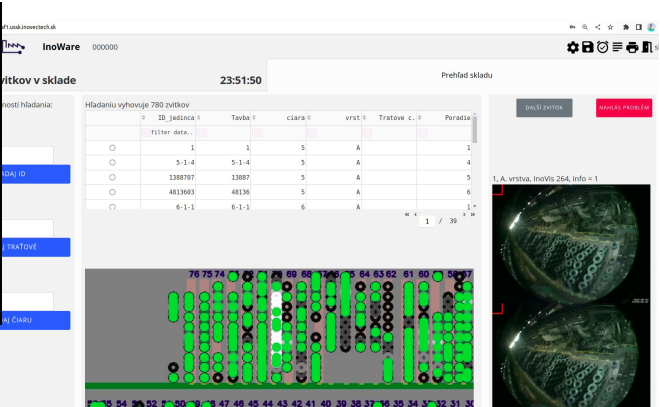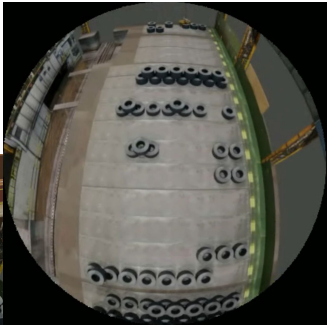
Railway wheel manufacturer has created a digital twin of their internal logistics

Situation

- Legacy warehouse overloaded due to high production
- Warehouse absorbing variability from several production units

Approach

- 40 robust edge devices with 80 cameras
- Integration with OPC to get SKU ID data from other systems

Impact

- Reduction of SKU search times by 95%
- Improved production flow, optimized layout arrangements for the material
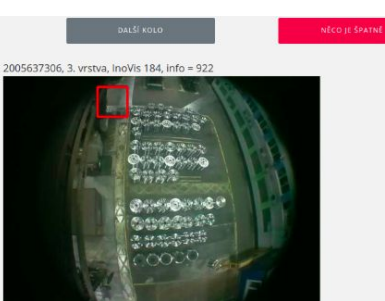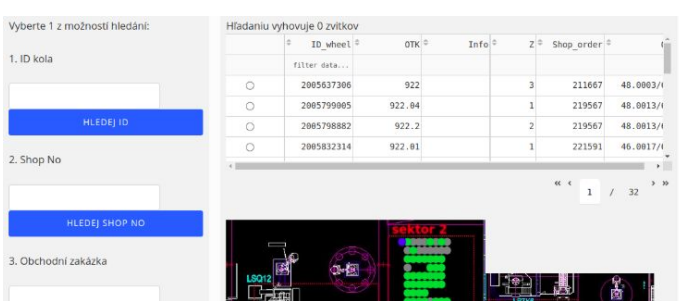
InovecTech has strong technical team with senior technology, application and academic advisors

Boris Fackovec, PhD
CEO, CTO
prev. McK mfg expert, transformation leader

Eduard Kofira
Head of data
math / data guru

UNIVERSITY OF CAMBRIDGE

McKinsey&Company

IBM

Imperial College London

Experienced technical team

Pavel Kohout Sr.
Sr. Developer
>25 years IT experience

Martin Galajda
Sr. Developer
prev. IBM, DB,AI startups

Jakub Horak
SW & HW engineer

Anna Tsurkan
Marketing and sales manager

Trong Dinh
Jr SW engineer

Diverse extended team

Vladimir Vozar
Jr SW engineer

Thi Hao Do
Data processing & marketing

Helena Votavova, PhD, data scientist

Peter Vanya, PhD
data science

Pavel Kohout jr.
HW and integration

Robert Rakay, PhD
OT integration

Accomplished Senior Advisors

Jesus Rueda, private equity principal and investor [strategy]
Jiri Matas, global leading professor in AI and Computer Vision, CVUT [AI**]**
Jan Petko, prev. logistics, plant director in US Steel
Petar Stanchev, 30 years of partnership building in SW, Aplis, Wise&Noble [partnerships,pricing,sales]
Klaus Beetz, former CEO of EIT manufacturing [partnership]
Martin Cavojsky, CEO of a B2B SaaS startup ExLink [devops, cybersecurity, sales]
Alexandra Mamrillova, head of sales for CZ scaleup, prev. Aero Vodochody [M&S]
Andreas Gams, 20 years of B2B sales, EIT Mfg[M&S]
Karel Zacek, 20 years in innovation management [strategy]
Ivan Tichov, 35 years of operations consulting [sales]
Lubomir Hulin, lean and BI expert [sales]
Tomas Metz, former global head of engineering of top consulting company, CIO of Sporitelna [technology,strategy]
Ondrej Komora, COO of a CEE startup [strategy]

Top 10 destination for Oxbridge graduates in CZ&SK

Over 60 experts, part-timers, students, senior advisers and top talent to be hired

InovecTech

Digital manufacturing transformation for all

The future is in effective human-machine collaboration

Inovec Technology s.r.o.
Za Poricskou branou
214/12, Karlín 186 00
Praha 8, Czechia
Org number: 09252606

www.inovec.tech

Emails:
info@inovec.tech

2025

Physical and a virtual sensor: an object generating an interpretable time series signal

Classical HW sensor

1. **Measured quantity**

2. **Electronically measurable quantity**

3. **Device / converter**

4. **Conversion of data into IT protocols**

Virtual sensor

"Raw data", e.g. an image

Data sources (e.g., physical sensor data)

Data suitable for digital twins
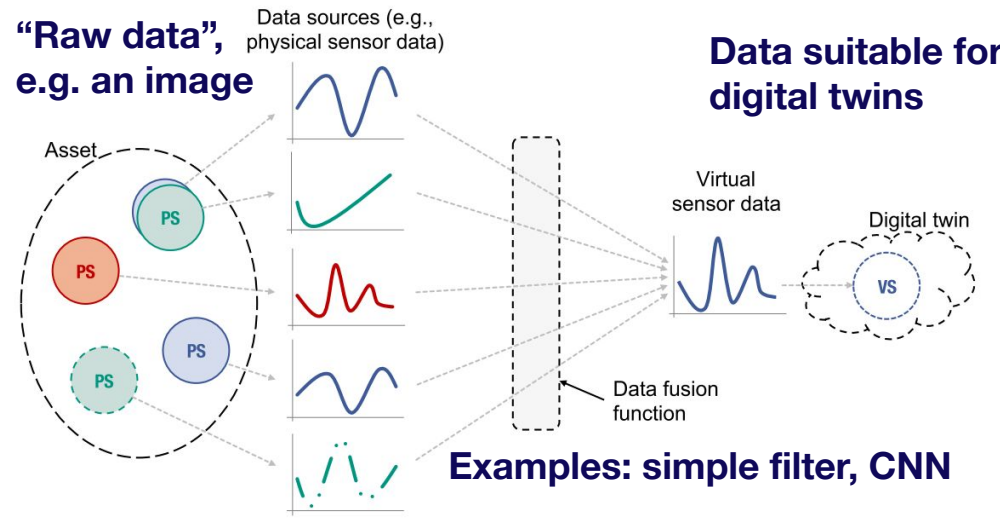
Fig. 2 Virtual sensor concept

Examples: simple filter, CNN

Adapted from Martin et al 2021, https://doi.org/10.1007/s12599-021-00689-w

1. **Input data**   2. **Model**   3. **Output data**

6 clusters of business processes are essential for best practice production management system

sensorics & regulation

KPI targetting

manufacturing mgmt

business analytics

process engineering

Manufacturing execution & OT

NC & robot programs

Performance mgmt

Continuous improvement

product engineering

maintenance

APS/APO

inventory mgmt

Product development

inventory control tower

finance & accounting

sourcing

MPS

budgeting

Integrated planning

Strategy & investments

Quality mgmt

quality control

S&OP

energy mgmt

SCM (supply chain mgmt)

HR mgmt.

HSE

Customer mgmt

audits & compliance

safety

sustainability

A wide range of specialized IT systems must be adopted to support the business processes

MES — Manufacturing execution & QoL
- sensorics & regulation
- manufacturing mgmt
- NC & robot programs

BI — Performance mgmt / Continuous improvement
- KPI targetting
- business analytics

PLM
- process engineering
- product engineering
- **Product development**
- sourcing

CMMS
- maintenance

APS
- APS/APO

WMS
- inventory mgmt
- inventory control tower

ERP — Integrated planning
- MPS
- budgeting
- S&OP
- finance & accounting

Strategy & investments

QMS — Quality mgmt
- quality control
- audits & compliance

infr.

SCM (supply chain mgmt)

HRM — HR mgmt.

ESG — HSE

EMOS
- energy mgmt

CRM — Customer mgmt

- safety
- sustainability