ESTEP 2025 Annual Event
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Udine (ITALY)

How decarbonisation, digitisation and circular solutions forge the sustainable European steel future?

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A MODULAR EDGE AI FRAMEWORK FOR INDUSTRIAL ENVIRONMENTS
Simple, easy to deploy, scalable quality-control

ESTEP
European Steel Technology Platform

DIGIMET

DANIELI AUTOMATION

UNIVERSITÀ DEGLI STUDI DI UDINE
HIC SUNT FUTURA

Edge AI for industry

Edge AI applied to IoT is a key area due to its high potential for exploitation, particularly in the manufacturing industry

- Local data processing
  - Responsiveness
  - Reduces cloud dependency
- Confidentiality of industrial data
  - Reduced operational costs
  - automation of controls, predictive maintenance
- Intelligent automation
 - Connection to ERP, quality control indicators

Implementation

- Embedded systems close to production lines
- Connectivity of data sources
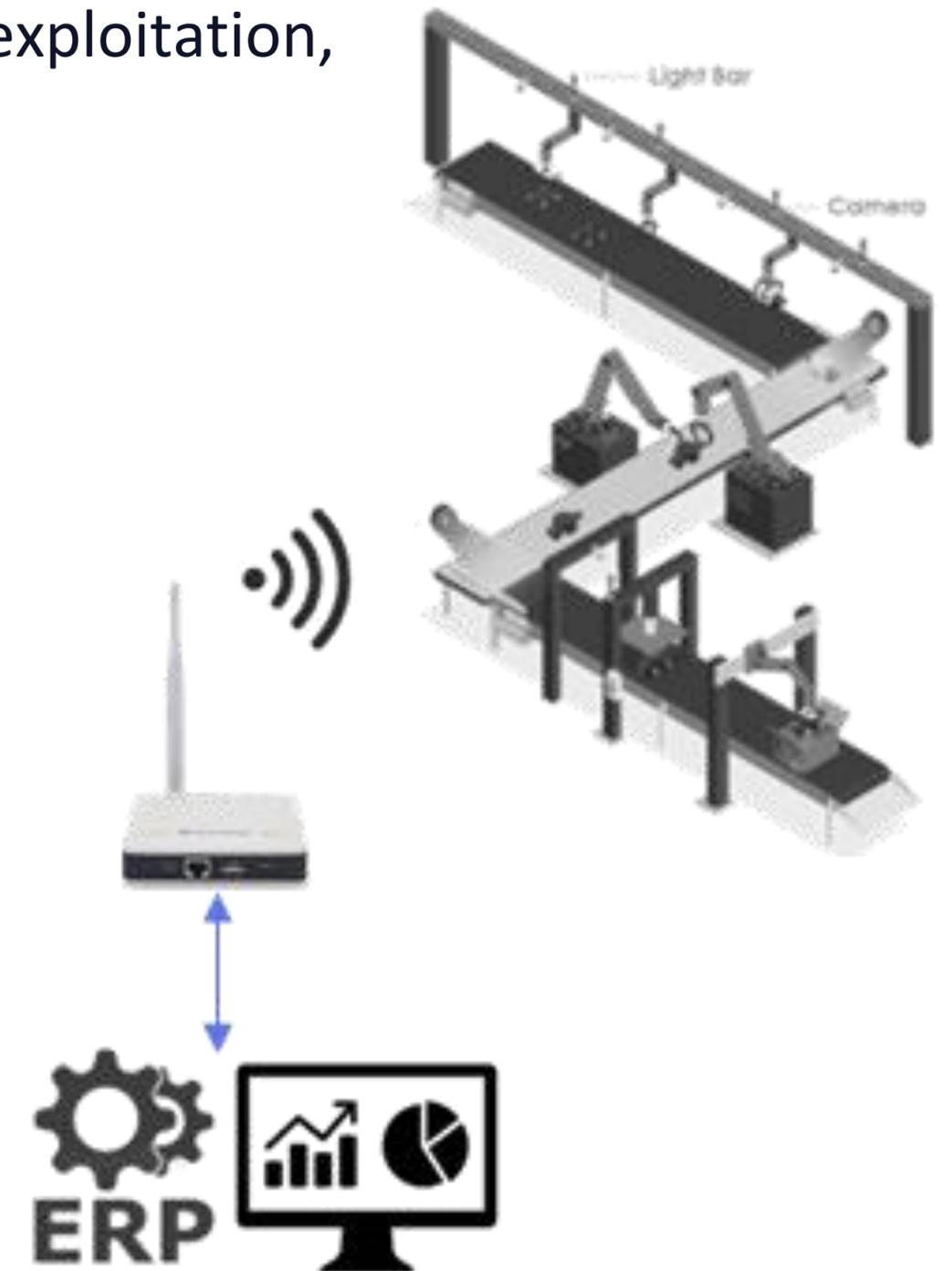
Use case: Assembly line control

- Aluminum pipe welding inspection on a virtual assembly line
  - Defect detection: alignment and welding
  - Image analysis using a neural network
- Simple functional architecture
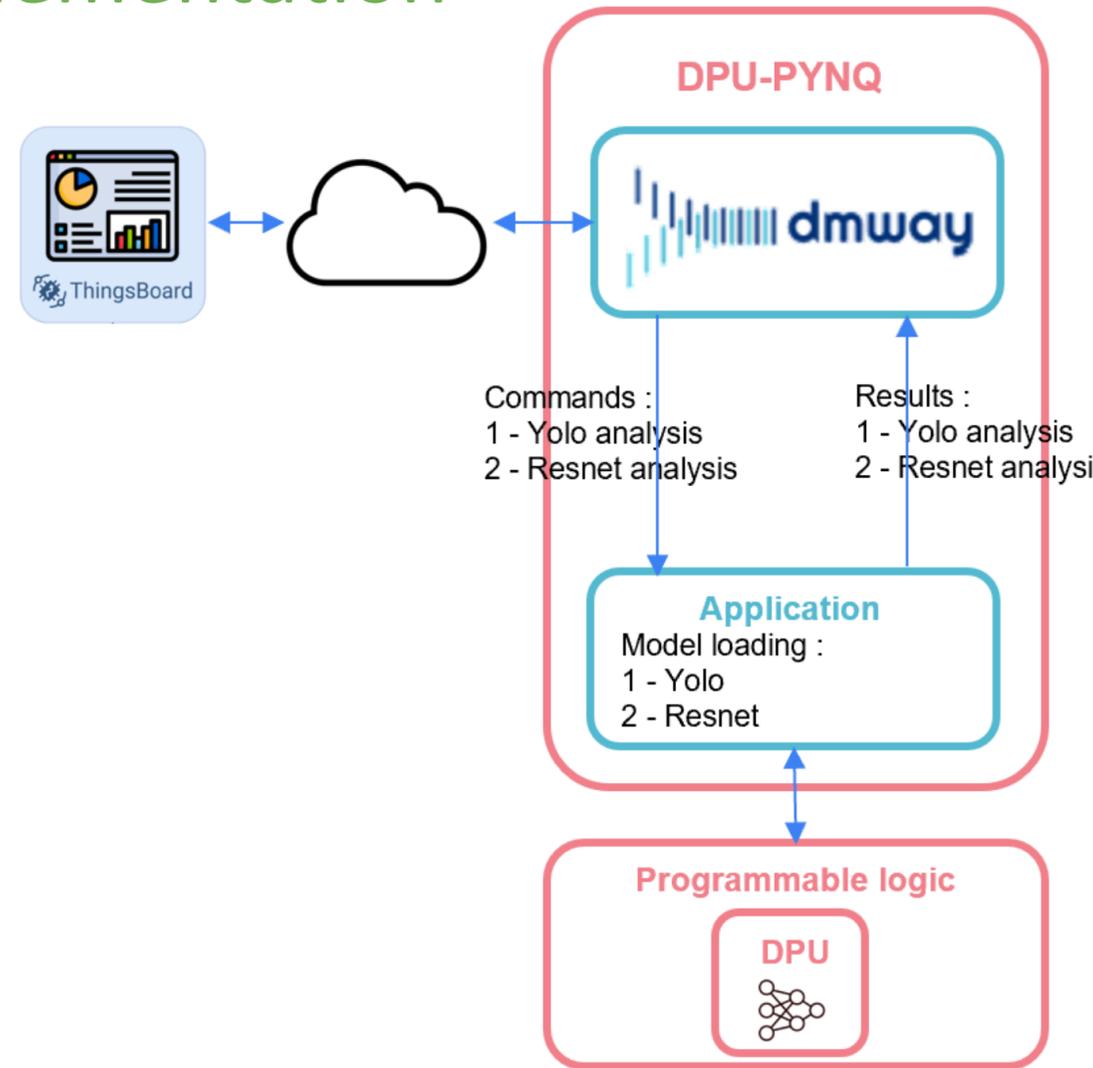 - Reusable for other computing vision applications
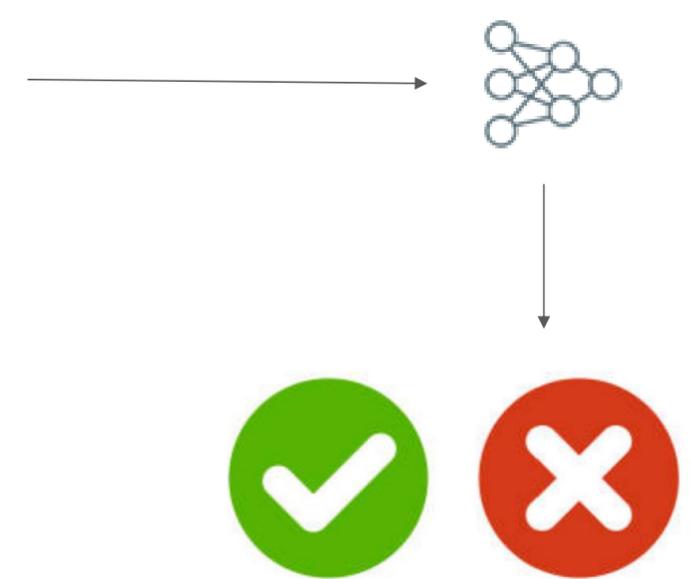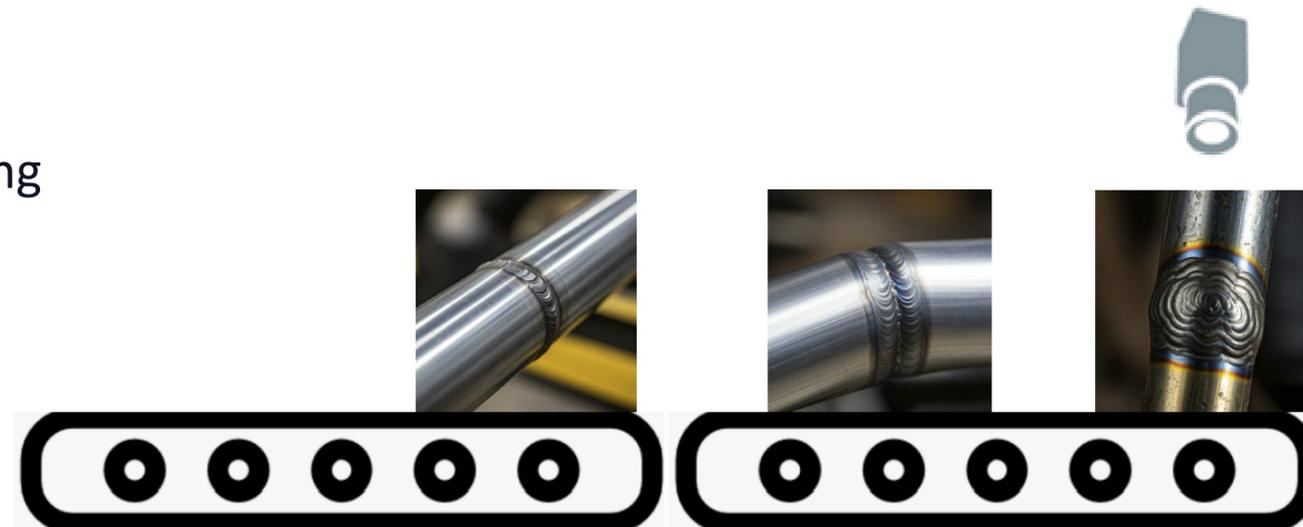
- implementation: SoC-FPGA board, AMD KV260
  - Images
  - AI
  - Sequencing of operations
  - Dashboard display
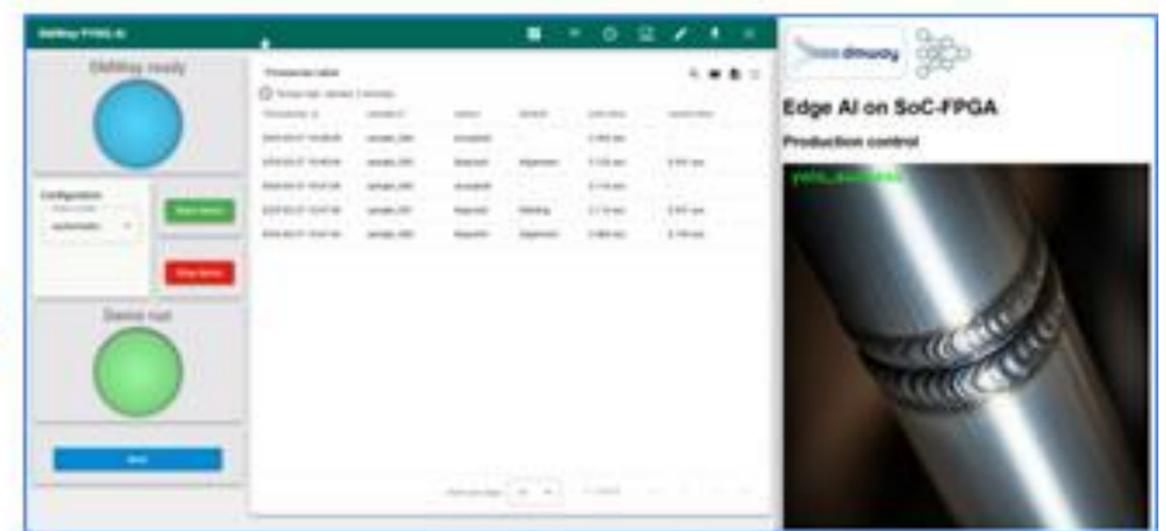
Demonstrator Architecture + Implementation

DMWay : Middleware for data flow management

- Simplifies integration of IoT systems
  - Interconnection of heterogeneous data sources and multiple backends
  - Data enhancement and semantics processing
  - Tasks orchestration
- A toolbox of specialized modules
  - connectors, protocols
- Native industrial connectivity + orchestration
- Centralized data management
  - enrichment, semantics
- Integration with ERP
  - Standard communication protocols : https, message queues, file exchange
  - Common data formats (JSON, XML, CSV)
  - Push, pull, bidir modes

DPU-PYNQ

ThingsBoard

dmway

Commands :
1 - Yolo analysis
2 - Resnet analysis

Results :
1 - Yolo analysis
2 - Resnet analysi

Application
Model loading :
1 - Yolo
2 - Resnet

Programmable logic

DPU

SoC-FPGA : Processor

- Application :
  - Order execution
  - Results
- SoC-FPGA : Programmable logic
  - Neural network
  - Detection
  - Classification

cetic
Your Connection to ICT Research