Zero-D

Process Parameters Optimization for Zero-Defect Manufacturing using Digital Twin based Predictive Quality

ORGANISATION PROFILE

**TEKKAN PLASTIK
(Large enterprise)**
Tekkan Plastik, which was founded in 1989, is one of the leading companies in Turkey in the field of plastic injection, plastic part production and assembly for household appliances and automotive sector. Tekkan also has available technology for design, production, and assembly of moulds. Tekkan is located in Kocaeli with an operating area of 26.000m2.

The R&D centre involves 36 researchers and technicians experienced in plastic composite materials, robot automation systems and innovative mould design.

Total: 51
Injection Machine

1400 tons

50 tons

Trade Mark Machine
- Arburg
- Jonwai
- Haitian
- Engel

PROPOSAL INTRODUCTION (I)

Vision: Zero-defect production with high performance by using real and synthetic data
- Generic hardware interface for seamless integration to different injection moulding machines
- Problem-specific AI approach for high accuracy models
- Explainable and interpretable models to support operator training

Motivation: Need of a robust and efficient system to optimize injection moulding manufacturing plants
- Energy prices surging world-wide, Carbon footprint needs to be diminished.
- With the advance of Industry 4.0 practices in the manufacturing plants, reliable and high volume/high frequency data is available from the operation.
- This data can be used to optimize manufacturing processes, with a focus on zero-defect manufacturing. Especially for the plastic injection sector, high scrap rate can be avoided and the operators can benefit from the use of AI based software solutions.

Content: Development of hardware and software components and their integration to operation environment
- Develop generic hardware and software technologies to acquire data from the manufacturing systems
- Develop a physically-coherent Digital Twin to model the operation
- Analyse the data and support decision-making
- Inform the system and the operators for zero-defect production

PROPOSAL INTRODUCTION (II)

Expected outcome: Increased productivity of the injection moulding manufacturing plants

- Development of a hardware and software integrated technology that uses real and synthetic data
- Cloud-based data storage that is accessible and reusable
- An intelligent and configurable framework that increases sustainability and profitability of the end-users

Impacts:

- Higher production rate for injection moulding manufacturers
- A supporting system that increases the knowledge and creativity of the operators
- Integration of reliable and continuous data into factory-wide decision making
- Decreasing the environmental impact by high efficiency operation
- Increasing awareness among manufactures in the light of Industry 4.0 practices

Schedule: ~ 2 years

USE CASE - Plastic Injection Process

Current State:
- Products with a diverse range in size, weight and value are produced 24/7
- Raw material and process costs are surging world-wide
- Poor quality and inefficient processes need to be addressed

Approach:
- Communication protocols and hardware infrastructure will be used to collect process data
- Digital twins which feed on real and synthetic data will be build for predictive quality purposes
- Support human operators will reliable and explainable AI-based technology
- Develop a framework that increase efficiency and ensure zero-defect production in a modular and extensible manner.

KPI:
- Scrap rate
- Overall Equipment Efficiency
- Material and Energy Cost
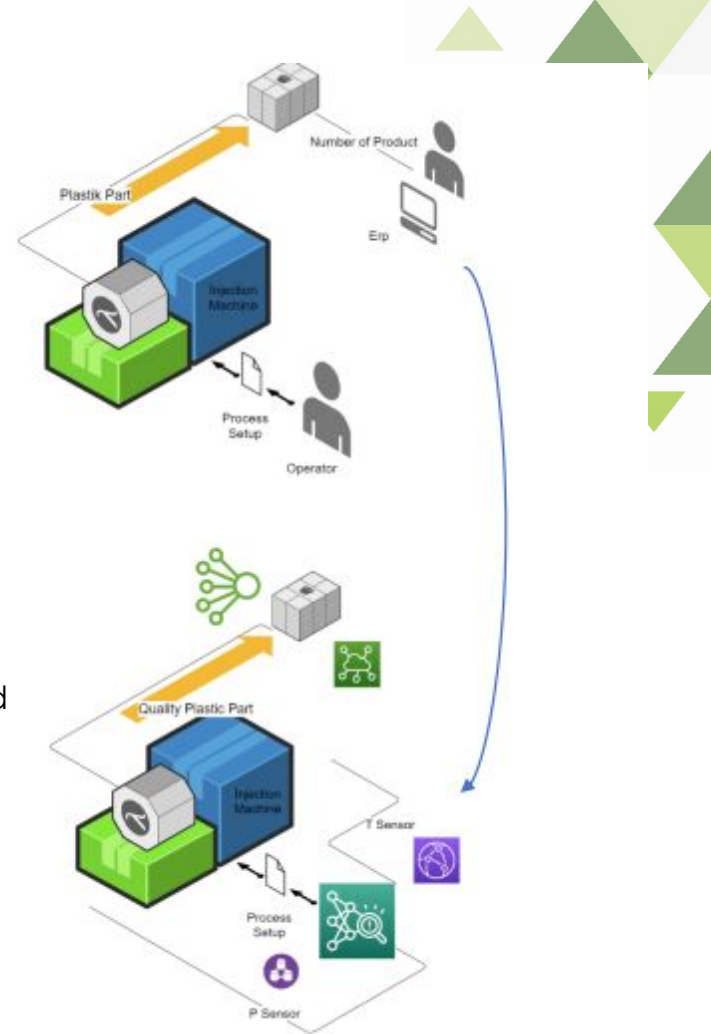
PARTNERS

Current Consortium:

Tekkan Plastik - Large Enterprise (TR) - https://www.tekkan.com.tr/
Role: Injection molding part manufacturer, end-user

Rotorbit - SME (TR) - https://www.rotorbit.com/
Role: Providing software solutions based on simulation and sensor data

Partner search:
- Hardware solution provider with expertise in sensor deployment (temperature, pressure signals, etc.)
- Hardware developer/integrator for data acquisition from manufacturing machines
- Additional manufacturing plants that can benefit from AI based support systems for zero-defect manufacturing (outside of plastic injection moulding sector)

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