SMART STEEL PIPE PRODUCTION PLANT via COGNITIVE DIGITAL TWINS: A CASE STUDY on DIGITALIZATION OF SWP

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22 October 2020
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R&D Performing SME

Research and Commercial Collaborations
The COGNITWIN project has received funding from the European Union’s Horizon 2020 research and innovation programme under GA No.870130.
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Introduction

• There are many Artificial Intelligence (AI) applications for real manufacturing plants.

• Digital twins with AI abilities are among these applications.

• Steel is an important sector, where AI applications have vast potential to provide positive impacts on different aspects, including energy consumption and cost benefits.

• This study briefs the COGNITWIN project’s NOKSEL pilot’s purpose, scope, state and the results gained in the 1st year.

Smart Steel Pipe Production Plant via Cognitive Digital Twins: A Case Study on Digitalization of SWP

Abstract
Smart Steel Pipe Production

- In steel pipe production, operations run on 7/24 basis
- Production process is serial and multi-step
- If a production step stops, the entire production stops
- **Problem:** The cost of machine breakdown is very high
- **Proposed Solution:** Development of Cognitive Digital Twin for production of Spiral Welded Steel pipes
- **Case:** NOKSEL İskenderun, COGNITWIN Steel Pilot

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The COGNITWIN Project
Cognitive Plants Through Proactive Self-Learning Hybrid Digital Twins

The project aims at adding the cognitive elements to the existing process control systems, enabling their capability to self-organise and offer solutions to unpredicted behaviours.

COGNITWIN will bring the industrial partners to a new level of Industry 4.0-driven operation by bringing in new data sources, integration of new and existing data, applying machine learning techniques to generate hybrid, self-learning and proactive systems, as parts of their digital transformation journey to cognitive plants.

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Cognitive Digital Twin

The Cognitive Twin (CT) in which asset will autonomously begin to detect changes in the process and will know how to respond in real-time to the constantly changing scenario with minimal human intervention will be developed. The CT will have cognitive capabilities by using operational real-time data to enable understanding, self-learning, reasoning and making decisions.

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Cognitive Digital Twin
Digitalization of SWP: NOKSEL Case

A digital twin on NOKSEL’s production process of Spiral Welded Steel Pipes (SWP) collects, integrates and analyzes multiple sensors’ data streams in real-time, and enables predictive maintenance by a smart condition monitoring system.

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NOKSEL Case

Target Goals

Work Performed

Future Work
NOKSEL Case: Target Goals

- Real time condition monitoring
- Predictive maintenance

- Target KPIs
  - 10% reduction in energy consumption, and
  - 10% reduction in shifted average duration of downtimes.

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NOKSEL Case: Work Performed

- System Architecture was created
- Sensors selections are completed
- Sensor implementations were completed
- Online stream data collected and processed realtime
- 3D models of SWP parts were prepared
- Digital twin visualisations were designed and implemented

- Physical Model was created
- Data driven digital twin was created
- Synthetic data were created

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NOKSEL Case: Future Work

- Hybrid digital twin studies are in progress
- Cognitive digital twin studies are in progress
- Machine Learning API for predictive maintenance, TeknoparTMML was enhanced by new models
- A new software for ML/DL testing has been designed
References

Thank You

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