REPLICA: a solution for Next Generation IoT and Digital Twin Based Fault Diagnosis and Predictive Maintenance

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Technology is advancing fast and helping industries to obtain more and more detailed data about their processes and equipment.
Introduction

The possibility to monitor and control each part of the process is a strong base on which a more intelligent and focused control can be built.

Technology advance brings innovation and the possibility to manage the production in terms of "near future" through AI prediction and decision-making support.

Forecasting demands and planning production, optimizing process by reducing costs and improving efficiency without corrupting the quality of the product is a big challenge at the plant level.
RE-manufaCturing and Refurbishment LArge Industrial equipMent (RECLAIM)

Duration: 42 months
Starting Date: 1 October 2019
Partners: 22 partners
Country Coverage: 8 countries
  Greece, Spain, United Kingdom, Italy, Switzerland, Portugal, Slovenia, Germany, and Turkey

High Level Objs

- Application of big data analytics techniques
- Predictive analytics and model-based forecasts and optimization procedures, based on completely data-driven processes
- Increased flexibility in changing machine operation purpose
- Re--manufacturing systems for material and resource efficiency
REclaim oPtimization and simuLatIon Cooperation in digitAl twin (REPLICA)

AIM: creation of a Digital Twin of the factory environment to be used to monitor and predict the performance and status of factory assets.

Objectives

Simulation and Optimization

Support digital retrofitting based on real data simulation

Introduce/enhance the smartness of the machinery

Deploy a digital retrofitting infrastructure

Provide a flexible, scalable architecture for intelligent digital twin

Provide Fault Diagnosis and Predictive maintenance tool
REPLICA Architecture

REPLICA is composed by several modules mainly subdivided in two blocks:

**Backend**

- **Artificial Intelligence (AI) Environment**
  - hosts the AI modules and the AI Engine.
- **Digital Twin Orchestrator (DTO)**
  - orchestrates all the operations done by REPLICA.
- **Simulation Environment**
  - distributed environment including several heterogeneous simulators deployed in different machines.

**Frontend**

- **OutputMonitor GUI**
  - Application devoted to show the results obtained using REPLICA.
- **Configuration GUI**
  - Application used to configure the components.
REPLICA technologies and standard
Use cases

**Deployment in industrial site**

- **Objective:** Simplify the development and deployment of a fault diagnosis and predictive maintenance solution based on digital twin.
- **Advantages provided by REPLICA**
  - Rapid customization to the present infrastructure, allowing the integration of already available IoT sensors, models, and AI algorithms.
  - Flexible deployment adaptable to the specific needs.

**Replacement of a machine in the shopfloor**

- **Objective:** Simplify the adaptation to change in the physical environment.
- **Advantages provided by REPLICA**
  - Rapid replacement of current components to adapt to the changed environment at runtime.
  - Intuitive interface to recreate the needed data flow with the new components.
Conclusion

Current innovative technologies allow implementing advanced fault diagnosis and predictive maintenance techniques based on Digital Twin.

REPLICA provides an architecture that can be customized in different scenarios, to ease the development and deployment of such solutions.

The solution combines open-source software with modules that will be developed ad-hoc during the RECLAIM project.

REPLICA will provide advantages in different industrial use-cases, from the deployment of fault diagnosis and predictive maintenance mechanisms in industrial sites, to their adaption to the changes in the shopfloor.
Thank you for your attention!

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