Industrial IoT Testbed

The "Industrial IoT Testbed" is a state-of-the-art Research Platform, showcasing the most advanced technologies used in Industrial Internet of Things (IIoT) such as:

- Time Synchronous Networking (TSN)
- Cloud-based System Monitoring and Management technologies
- Augmented Reality Visualization

TSN Demonstration System allows to achieve high precision timing synchronization between two networks over a single Ethernet connection using IEEE 802.1AS standard, along with the capability of deterministic data transfer using IEEE 802.1Qbv standard.

Cloud-based System Monitoring and Management technologies are applied to a small-scale Water-Circulation system, equipped with a number of sensors and fault-insertion systems. The initial signal processing is performed on the Edge Devices that publish all the acquired data over OPC-UA and make it accessible to on-premise Cloud services of visualization, analysis and predictive analytics.

The Management and Control of the Testbed is performed remotely via Web-Interface that gives the operator real-time data acquired by the Edge Devices and ability to insert various faults into the system.

The System provides high level of flexibility to process and modify the data adding Predictive Analytics functionality and predicting the possible faults with Artificial Intelligence.

Features

- IEEE 802.1AS and IEEE 802.1Qbv based timing synchronization and data transfer
- Visual demonstration of synchronization accuracy
- Small-scale Water Circulation System
- Data Acquisition from Vibration, Temperature, Pressure sensors and Flowmeter
- Data Acquisition from IR Camera

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- Voltage and Current measurement
- Asset Health Diagnosis
- Edge signal processing with NI InsightCM
- Data Analysis and Visualization with NI InsightCM running on a Server (Trend Waveform, FFT, Waterfall, Full Spectrum, Order Waveform, Order Spectrum, Envelope Waveform, Envelope Spectrum, Orbit, Bode, Polar, Shaft Centerline, MCSA Spectrum, MCSA, Torque Waveform, Channel Table)
- Predictive Analytics and data visualization in PTC ThingWorx on-premise cloud
- Cloud-based System Management and Control using NI SystemLink
- Data visualization in Augmented Reality using PTC Vuforia Studio and Microsoft Hololens
- Mechanical and Hydraulic fault simulation capabilities

Technical Specifications

Parameter	Value
Data Transfer Protocols	AMQP, OPC-UA
TSN Protocols	IEEE 802.1AS, IEEE 802.1Qbv
Maximum Temperature of the Motor	80 deg. C
Maximum Temperature of the Pump	60 deg. C
Minimum Flow	20 l/m
Maximum Flow	300 l/m
Maximum Pressure	0.1 bar
Maximum Vibration (Acceleration)	0.5 g
IR Camera Temperature Range	0 – 300 deg. C
Power Consumption	3 kW

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