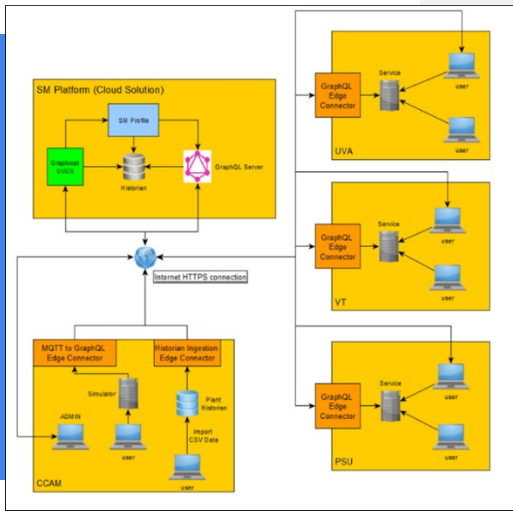
Industry
Aerospace & Defense
Composites

Technologies
Data Analytics
Machine Learning
Predictive Modeling

Solutions
Asset Performance
Energy Efficiency

PROJECT CASE STUDY

Energy Efficient Material Processing



PROJECT LEAD

Virginia Tech

PROJECT TEAM

Penn State, University of Virginia, Commonwealth Center for Advanced Manufacturing, Honeywell Aerospace

PROJECT OBJECTIVE

The goal of this project is to demonstrate energy efficient material processing through advanced sensing, automated process monitoring and model-based controls.

Automated Process Control Improves Efficiency of Energy-Intensive Heat Treatment Processes

BENEFITS TO OUR NATION

- Intelligently monitoring and controlling heat treatment processes for similar manufacturing plants would yield energy savings of 800,000 to 1,000,000 kW of power.
- A reduction of energy use of only 15% could save $100,000 annually for a single heat treatment process.

BENEFITS TO INDUSTRY

The project team deployed strategies for realizing a 15% reduction in energy consumption for thermal treatment of composite parts. The developed technologies could be adopted in aerospace, automotive, heavy equipment and any other industries that implement thermal processing for discreet part manufacturing.

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PROJECT DESCRIPTION

TECHNICAL APPROACH

Self-powered wireless sensor nodes and deployment of energy harvesting approaches; Efficient computational framework to acquire, post-process, and synthesize large quantities of sensory data in real time; In-process monitoring capability with offline big-data analysis techniques; Closed-loop system to enable real-time, model-based control for energy consumption optimization.

ACCOMPLISHMENTS

- CESMII Smart Manufacturing Innovation Platform was configured and tested on data from the Simulation tool.
- Developed a lab-scale CVI processing platform; temperature, power, and pressure sensors were used to control the process parameters accurately.
- A LabView program was developed to visualize the furnace's temperature profile, current, and energy usage via a cloud service.
- Created an at-a-glance maintenance detection tool that Determines similarities between human interpreted historical runs and the run of interest and displays results on a 2D plot.

DELIVERABLES

- Delivered Functional Requirements Documentation and Conceptual Architecture for a Data System Supporting Data Acquisition, Simulation, and Analysis of Honeywell's Chemical Vapor Infiltration (CVI) Process.
- Devised recommendations for additional sensor technologies applicable to the Chemical Vapor Infiltration process monitoring.
- Delivered complete KPI (carbon gain) prediction and energy consumption forecast.
- Delivered a generalized framework that finds inputs to an externally provided forecasting model to maximize a value derived from the forecasting model's predictions.
- Delivered Maintenance Optimization Tool that reads historical sensor data, clusters similar runs, and graphically displays the output.

REUSABLE OUTCOMES / SM MARKETPLACE

- Key Performance Indicator prediction Apps.
- Energy consumption monitoring Apps.
- Process optimization and control algorithms for CVI furnace applications.
- Control system that uses analyzed data to enable real-time, model-based control for energy consumption optimization of chemical manufacturing processes.

RESULTS

↑ $500K/yr

Potential savings from improved yield (reduced scrap) for a single furnace.

↓ $3.8M/yr

Potential maintenance cost reduction from implementing maintenance optimization tools in a typical plant.

↓ 1.5 PJ/yr

Potential energy savings at a typical plant that runs heat treatment equipment.

PROJECT DETAIL
Budget Period: BP2-4
Submission Date: 06/01/2022
Sub-Award (contract) Number: 4550 G WA327
SOPO: 239

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