Optimizing Predictive Maintenance (PdM) by Integrating IoT Vibration Data and Process Control Data

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Donald Von Raesfeld (DVR) Power Plant
Santa Clara, CA - Operating since 2005

148 MW Combined-Cycle Plant
2 LM6000 gas turbines
1 steam turbine

150+ balance-of-plant assets (BOP)

90% of sales come from commercial customers
Commercial: 9,000 customers
Residential: 45,000 customers
Enterprise Agreement with OSIsoft

Started with Generation, expanded to substations, and now part of AMI system

The PI System helps us
- Optimize Generation and Distribution assets
- Track process parameters to ensure uptime and operational efficiency
Unplanned Downtime of BOP still a big problem

Comes with significant repair costs and reduced capacity

Ex 1: Gas turbine shutdown
For 4 weeks after generator fan failed

Ex 2: Reduced overall capacity
Due to condensate pump downtime
Traditional PdM methods for BOP not effective

- BOP assets monitored monthly with manual walk-around PdM
  - Infrequent data collection
  - Operating conditions not aligned with data collection visits

We needed a monitoring system that’s *continuous* and *automated*
Implemented Industrial IoT from Petasense

The technology
Wireless Vibration Sensors
Cellular Gateway + WiFi APs
Cloud-based Analytics

Critical BOP assets
Pumps (Boiler feed, Condensate, Circ water)
Fans (Generator, Cooling Tower)
Gas compressors
Industrial IoT: How it works

1. CONNECT
   Wireless Vibration Sensors

2. COLLECT
   Machine Learning Cloud

3. MONITOR
   Web & Mobile Apps
IIoT Advantage: More simple, more affordable

- No wiring costs
- No PLCs required
- No dedicated server hardware
- No systems admin needed
Immediate benefits with IIoT based PdM

Generator Fan

Function
Cools the Generator enclosure and Generator

Case Summary
Avoided unplanned shutdown thanks to alerting from the IIoT-based PdM system
IIoT system prevented unplanned downtime

Vibration Alert
Fan Drive-End

AUG 26, 2017
IIoT system prevented unplanned downtime

- **AUG 26, 2017**
  - **Vibration Alert**
  - Fan Drive-End

- **AUG 28, 2017**
  - **Greased bearings**
IIoT system prevented unplanned downtime

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- **AUG 26, 2017**: Vibration Alert
  Fan Drive-End

- **AUG 28, 2017**: Greased bearings

- **SEPT 3, 2017**: Shut down fan
  Inspected belts and re-greased
lIoT system prevented unplanned downtime

AUG 26, 2017
Vibration Alert
Fan Drive-End

AUG 28, 2017
Greased bearings

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Shut down fan
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SEPT 17, 2017
Defect Confirmed
Motor misalignment and Mid-stage bearing wear
IIoT system prevented unplanned downtime

AUG 26, 2017  Vibration Alert
Fan Drive-End

AUG 28, 2017  Greased bearings

SEPT 3, 2017  Shut down fan
Inspected belts and re-greased

SEPT 17, 2017  Defect Confirmed
Motor misalignment and Mid-stage bearing wear

SEPT 18, 2017  Fan taken out for repair
Petasense provides turn-key integration with OSIsoft PI

Universal File and Stream Loading (UFL) to continuously send IoT data into PI Vision
Data flow from Petasense to PI Data Archive

PETASENSE MOTES ➔ PETASENSE CLOUD ➔ SVP DATA CENTER

- PETASENSE MOTES
- PETASENSE CLOUD
  - Petasense Database
  - Petasense PI Server
- SVP DATA CENTER
  - Scheduler
  - PI Vision
  - Petasense UFL Client
  - PI Data Archive
    - Tags, PI points, Time series data
  - UFL Connector
    - REST server mode

API Request ➔ API Response
Integration pilot: Sending vibration data to PI
Benefit 1: Leverage existing investment in PI

Improve your PI System ROI
- Leverage tags by integrating IoT data streams
- Leverage personnel who already monitor operations through PI

Make PI the primary destination for all industrial IoT data
Benefit 2: Process data + asset data = better PdM

- Identify if pumps are operating at BEP
- Determine health of seals
- Identify system issues (e.g. deadheading)
- Optimize PM for RO process using real-time data
Key takeaways

1. Use PI as a single source of truth for industrial data

2. Improve your asset reliability by combining process data with asset data

3. Leverage Industrial IoT to reduce maintenance costs and eliminate unplanned downtime
What’s next for Silicon Valley Power?

Multiparametric IoT Sensors

- Cover more types of assets and more data from rotating assets

Integrating process data from PI to Petasense

- Leverage Machine Learning for richer analytics and diagnostics
Thank You

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